SCIENTIFIC AMERICAN

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NEW LASTING MACHINE.

It would be difficult to name an industry in which mechanical skill and invention have produced such marked effects as in the manufacture of shoes. The cutting of the uppers, soles, and heels, the treeing, pegging, stitching, finishing, and eyeleting, are all done by machinery, and many of the minor operations in the manufacture of shoes are accomplished by improved tools which greatly facilitate the work and cheapen the cost of manufacture. But hitherto lasting has been principally done by hand, making it a comparatively slow operation.

We give an engraving of a machine recently patented by Mr. S. B. Ellithorp, of Rochester, N. Y., for accomplishing this work with rapidity and uniformity. The machine is equally well adapted to boots and shoes, and it is so clearly shown in our engraving that any one familiar with boot and shoe machinery will be able to understand it without reference to the description.

The frame of the machine is made of the base and top pieces, connected by vertical iron rods at the corners. The plates, A, are suspended by connecting rods from levers, B, pivoted at the top of the frame, and the levers are connected with arms on the rockshafts, C, so that when the latter are partly rotated the plates will be raised or lowered more or less.

The plate, A, carries a number of adjustable hooks, E, provided with nippers or clamps. F, which grasp the edges of the uppers surrounding the lasts, G.

The machine shown in the engraving holds two lasts, and is capable of lasting two uppers simultaneously. In the present case the uppers are omitted in the first half of the apparatus to avoid confusion in referring to the different parts. Two levers, I I, are provided for each last. They are pivoted to a standard in front, and are elongated at the opposite extremity, forming handles which are brought together and retained by a link after the operation of stretching the uppers has been performed.

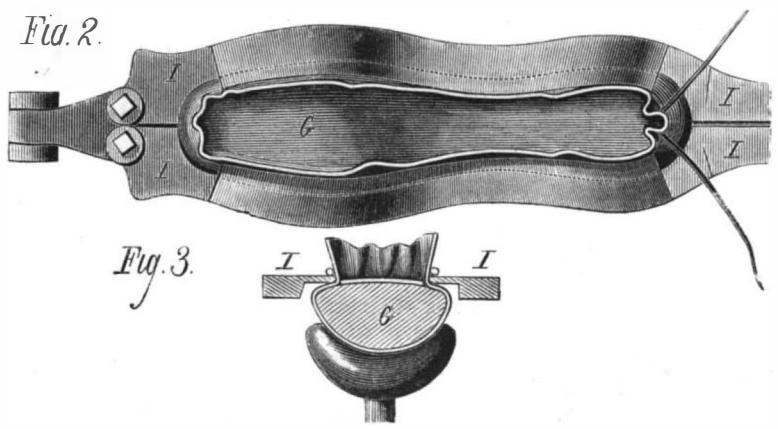
The lasts are held down upon their seats by screws, K, passing down through nuts in the top of the frame and bearing upon the center of the lasts.

The standards which support the last seats are made adjustable, so that they may be raised or lowered for different sizes of shoes and for boots.

The devices which hold the last render it adjustable in every direction, so that a last of any size may be used in the machine. The hooks on which the nippers are hung are capable of being adjusted, and the screw that holds the last down may be adjusted so as to press upon any part of the last.

The shafts, C, are provided with hand wheels, J, and with levers, by which they may be turned so as to bring any desired amount of strain upon the leather.

To last a boot or shoe on this machine the upper leather that has been prepared for lasting is turned bottom up and the last inserted therein bottom up, the last having an insole already tacked on the bottom. The last is then placed bottom up in the seat, so that the pin (Fig. 3) enters the corresponding hole in the last, the toe of the last resting in a curved seat, supported by the adjustable standard. The plate, A, is then lowered to the full extent, and the clamps, F, are adjusted so as to grasp the upper leather all around the edge, first grasping at the center at the heel, then at the center at the toe, and then, at proper distances apart, all around the upper. The holding bolt is then forced down upon the last, holding the last firmly down on the seat. The plate, A, is then drawn up by turning the shaft, C, pulling up the clamps, E, and consequently the upper leather, closely to the last at every point alike. The last being firmly held down, all the surplus leather of the upper leather is then above the bottom of the last. The levers, I, are now closed, pressing the upper leather to the shape of the last all around the bottom about the insole.



LASTING MACHINE—PLAN AND SECTION OF LAST.

A gathering cord is then placed about the upper leather and drawn tight. The cord is again pulled and secured, and the boot or shoe is then lasted ready for tacking, which may be done in the machine while the last rests on the seat on opening the levers; or the boot or shoe may be removed and then tacked.

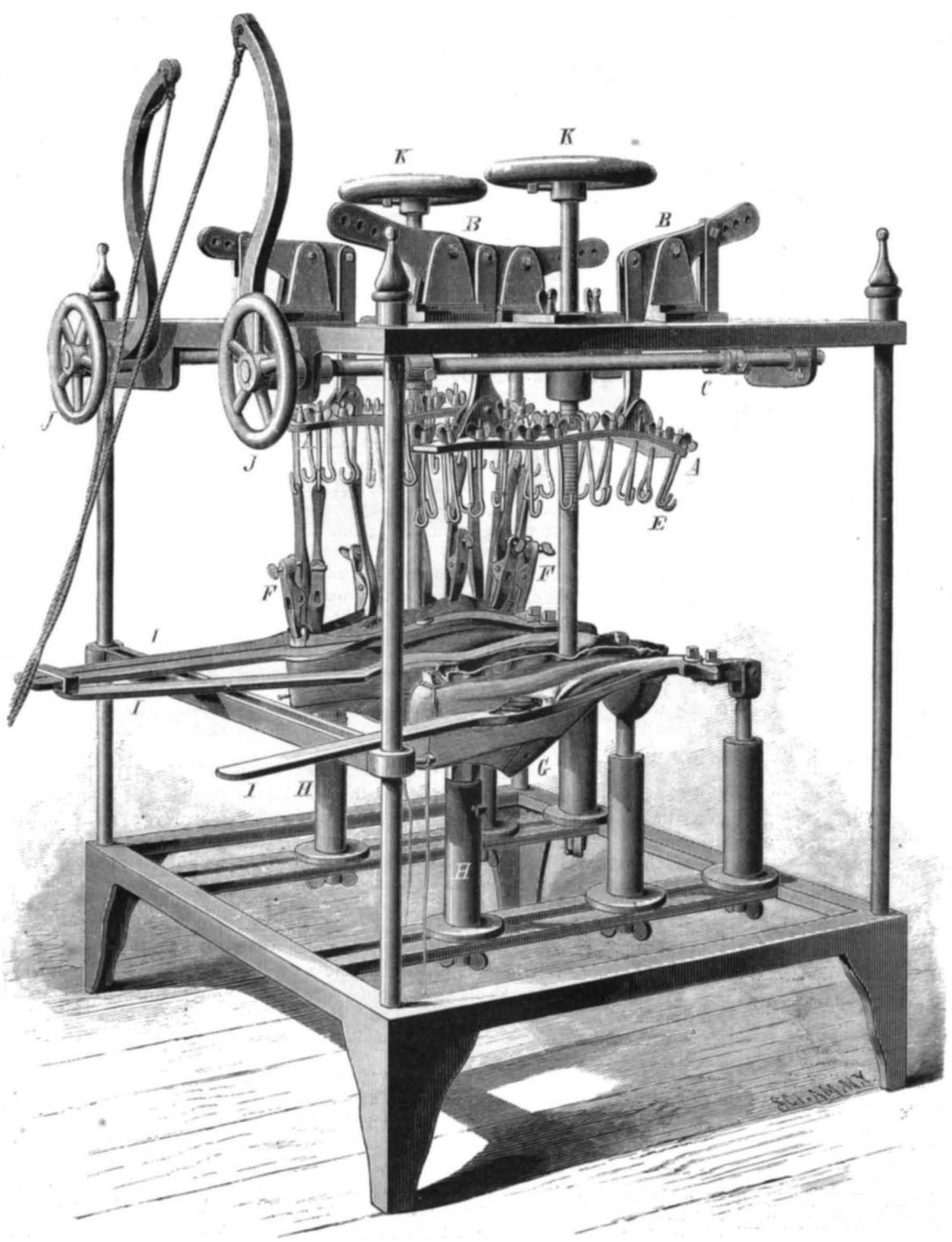
It has been supposed by some that there were mechanical obstacles that rendered it impossible to last boots or shoes by machinery. Such obstacles, if there were any, have been successfully overcome by this invention, by which boots or shoes of all grades of stock may be lasted in a manner far superior to hand work.

This machine is simple and easy to operate; a girl or boy can operate it and do better work than is usually done by hand.

To produce a handsome boot or shoe and a good fit it must be perfectly lasted; this every practical man in the trade admits; and it is equally true that not one pair in ten is properly lasted.

The inventor says that with this machine it is hardly possible to last a boot or shoe imperfectly. It will do perfect work with all kinds of stock, and it may be operated by hand or power.

Further information in regard to this useful invention may be obtained by addressing the inventor as above.



ELLITHORP'S BOOT AND SHOE LASTING MACHINE.

The Division of the Comet Doubted.

Owing to the persistent bad weather and the rapid retreat of the comet into space it is to be feared that the question of the comet's spontaneous division on the night of July 6, as reported by Professors Stone and Wilson, at Cincinnati, will not be satisfactorily settled. The astronomers of the observatory at Washington saw a great disturbance in the coma about the nucleus of the comet the same night, and a partial separation, which might appear as a complete division in the less powerful glass employed at Cincinnati. Other astronomers are confident that no division of the nucleus occurred.

Unfortunately, as already noticed, the atmosphere has since been very unfavorable for such observations, and the question threatens to go undecided until the comet comes back again—if it ever returns.

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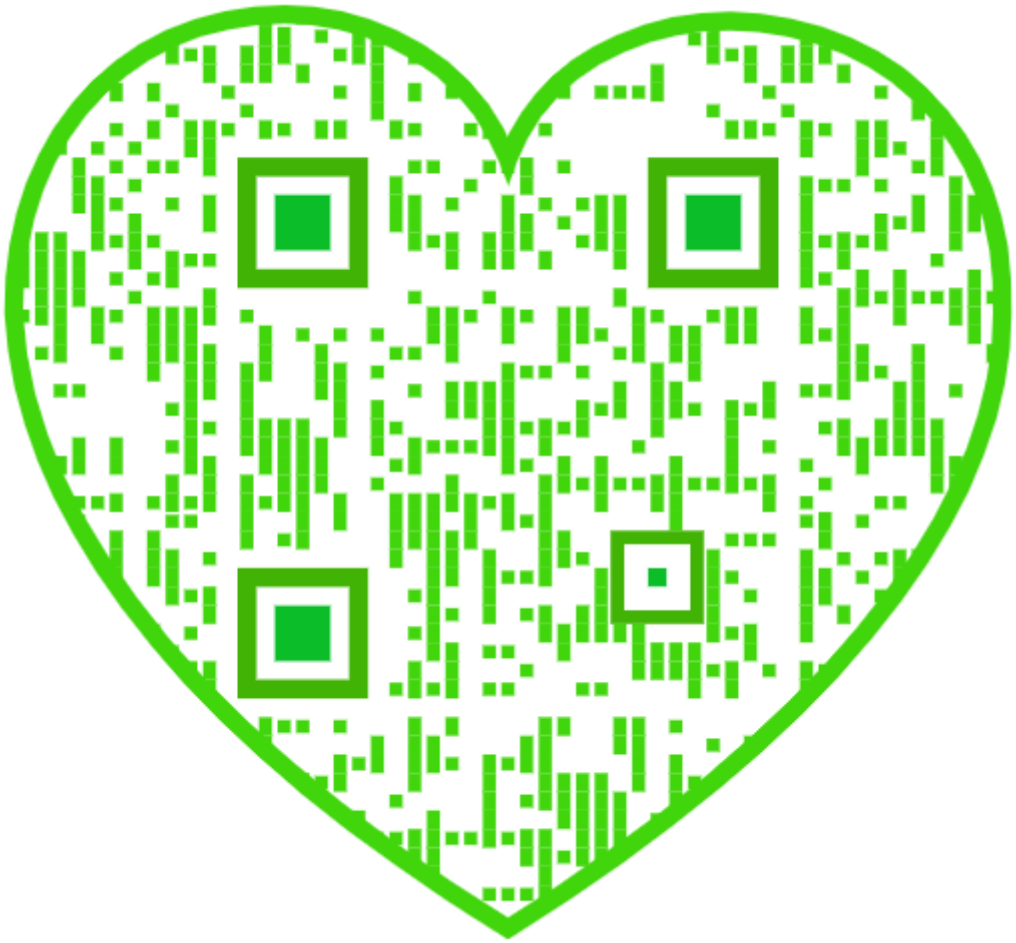

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NEW YORK, SATURDAY, JULY 30, 1881.

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DR. GRISCOM'S FAST.

At noon, July 12, Dr. John A. Griscom completed, at Chicago, a self-imposed fast of forty-five days. During the fast he drank 1,433 ounces of water, or about two pounds a day. When he began he was in fine physical condition and weighed 197¼ pounds. At the close of the fast he weighed 147½ pounds; his pulse was 66, respiration 15, temperature 98° Fah. On the first day of his fast his pulse was 84, and his temperature 100°. He suffered but little during the fast, and his strength held out wonderfully. To the last his muscular power exceeded that of most men, and his mind was perfectly clear.

The faster was watched by a number of reputable physicians, and a scientific record of his condition was kept from day to day. The official summary of the record, it is promised, will add materially to the physiology of fasting, while certain of the results are said to be fatal to some of the accepted theories of medical men.

It will be observed that—if the evidence of Dr. Griscom's case holds generally—a man in good physical condition, subsisting upon water and his own store of flesh, consumes about one pound of solid food a day when leading a fairly active life. This closely coincides with the figures given by physiologists. For an average man at ordinary labor, Dr. Letheby estimates, on the experiments and observations of a large number of investigations, a daily requirement of 5·688 grains of carbon and 307 grains of nitrogen, or nearly six-sevenths of a pound; while, for active labor, the carbon and nitrogen required weigh together about one and one-fifth pounds. Dr. Dalton's observations indicate a more liberal diet as necessary for a man in full health taking free exercise, his quantities being equivalent to 16 oz. meat, 19 oz. bread, 3½ oz. butter—or nearly 2½ pounds of mixed food, and about three pints of water.

It would seem from these figures that the absorption of food from one's own bodily store of flesh costs considerably less energy than the digestion and assimilation of food in the usual way. In any case, a man in good health, with fifty pounds of surplus flesh, can safely reckon on nearly as many days of life, in case of enforced abstinence, or for voluntary abstinence, as for the cure of disease.

The purpose of Dr. Griscom's fast, he says, was to impress people with the utility of fasting and the possibility of long-continued fasting without severe pain. He believes that much of the sickness and physical distress men suffer from may be attributed to the overcrowding of the system with food and food products, and that very many maladies may be cured simply by abstaining from food for a longer or shorter period. The daily observations upon the blood of Dr. Griscom are said to prove the important fact that the relative number of blood corpuscles is not materially diminished by fasting; and there is reason to expect that, when the details of the physicians' observations are digested and published, the sanitary value of fasting—and of eating less, habitually—will be scientifically established. As a remedy for obesity, fasting—partial or complete—would seem to be both safe and efficient; but it must be persisted in for longer periods than have heretofore been thought prudent. Curiously, the distress of hunger seems to vanish after a few days' abstinence.

AN ANCIENT AQUEDUCT REOPENED.

After a breach of 1,600 years the aqueduct built by the Emperor Augustus to supply Bologna with water was restored to use June 5. Nineteen hundred years ago the imperial engineers tapped the Setta near its junction with the Reno, about eleven miles from Bologna, and brought its water to the city through an underground passage. They followed the course of the Reno, tunneling the hills, sinking their work beneath the beds of the precipitous torrents which rush from the mountains into the river, and bringing the waters to the gates of the city, where they were divided, one portion going to supply the public baths, and the other probably destined for the fountains of streets and public squares.

The work of tunneling and the masonry were so thoroughly well done that both stonework and brickwork are still as solid as the rock itself, the only considerable breaks being where the turbulent Reno had washed away with its clayey banks several portions of the aqueduct, or where the headlong torrents which rush down into its stream had excavated their own beds and carried away the artificial substructure.

The restoration of this important work is due chiefly to Count Gozzadini, who caused an accurate survey of the aqueduct to be made about twenty years ago, and in 1864 published the results of the investigation in an elaborate memoir. Since then the work of restoration has been going on with a thoroughness and skill calculated to make the new work as enduring as the old. The aqueduct was originally made of brick and stone cemented with lime and volcanic sand, and the unbroken portions remained as hard as granite.

INCONVENIENCES OF ELECTRIC STREET RAILWAYS.

The hope that electricity might prove an acceptable substitute for horse power in operating street railways meets with an unexpected rebuff in the working of the electric railway at Berlin. The electricity, it will be remembered, is conveyed to the carriages by one rail and returns by the other rail. The current being of low tension the electricity does not leave the track except when connection is made between the two rails. Accordingly, either rail may be safely touched, stepped on, or walked on by men or animals. But when both rails are touched at the same time, as easily happens when a horse crosses the track, an unpleasant if not dangerous shock is received. Where the Berlin road crosses wagon roads at grade it has been necessary to make a special arrangement to avoid this difficulty by putting one rail out of circuit and connecting the adjoining rails electrically by means of a covered conductor. For elevated or for depressed roads this objection does not hold; and the electric railway promises to fill a wide field of usefulness in such connections.

THE GAFFNEY BOILER EXPLOSION.

This accident, which took place June 1, was very fully illustrated and described in the SCIENTIFIC AMERICAN, July 2. On that occasion we commented upon the erroneous nature of the verdict rendered by the coroner's jury, which reads as follows:

"The inquest appointed to inquire as to the causes of the deaths of F. C. Harbeson, Frederick Dusher, and Robert Bradley, on June 1, 1881, find that they came to their deaths by an explosion of a boiler at the dye works of Gaffney & Co., situated on Collins street, opposite Tucker street, and that the explosion was due to the improper use of cast iron in the flat head of the boiler. We also find that no skilled attendant was employed to care for the boilers, and that the attendant performed other duties that withdrew him at times from the care of the boilers. The inquest consider that the Hartford Boiler Inspection and Insurance Company are especially censurable for the incompetence and negligence of its agents who inspected and certified to the safety of this boiler, and they urgently recommend that the proper authorities take measures to prevent the recurrence of disaster so terrible in its results."

In the course of our remarks we called attention to the fact that the steam-stop-valves were found, after the explosion, to have been shut; and we suggested that this closure of valves and the probable inoperation of the safety valves produced an over-pressure of steam—it being the dinner hour—which resulted in the bursting of the boiler.

It will be noticed that the jury find that no skilled or licensed attendant was employed to care for the boilers; and that the inexperienced person who fired them had other work to perform that took him away from the boilers at times. The jury do not condemn this method of running boilers, nor do they find any fault with the proprietors for employing unskilled persons. Most engineers, we think, would say that the strongest boiler in the world might burst when run in the careless manner certified to by this jury.

We also blamed the jury for neglecting their plain duty in not subjecting the two remaining boilers, which were uninjured, to proper tests as to strength.

One of these jurymen, Mr. Nystrom, who assumes to be an engineer, sends us a communication, which we publish elsewhere, in which he throws new light upon the reasons why the jury brought in this verdict. He says "the boiler head evidently burst by shrinkage or expansion strain in the casting." The other members of the jury appear to have accepted this as correct, but it looks to us as erroneous. They appear to have had no data, and made no experiments to determine the value of this opinion.

From Mr. Nystrom's letter it would also seem that both himself and the others of the jury were fully satisfied without making the trials just what the results of such tests would be; and, consequently, did not go to the trouble of making them. Mr. Nystrom says: "Such an experiment would have been of no practical use, for the jury would probably have found that the shell of the boiler bursted without injuring the head."

Those who read the interesting report given in another column, of a recent test, such as we suggested, will see how little reliance can be placed upon the books or the opinions of an engineer like Mr. Nystrom, who had the easy faculty of appealing to his own imagination for information rather than to the practical teachings of actual experiment.

Mr. Nystrom states that the Hartford Boiler Insurance Company has ordered its inspectors in Philadelphia not to insure flat cast iron headed boilers over thirty inches in diameter. If this is so, we shall have less respect for the judgment of the managers of that company than heretofore. There are so many boilers now running having flat cast heads, they work so safely and so well, that it seems absurd for anybody to undertake any crusade of alarm against them. We have no expectation that boiler-owners will be affected by any such proceedings. The true position is that expressed by the City Solicitor of Philadelphia, who advised the City Inspector, when, in his judgment, a boiler is safe, to approve it and give a certificate, without regard to the mode of construction.

Messrs. Sidebotham & Powell are certainly entitled to great credit for the open and impartial manner in which their recent test was conducted. It is but an example of the pains they take to ascertain the value and strength of the materials they use; and it will add to the high reputation they have long enjoyed for superior excellence in boiler work of all kinds.

Harris' Mechanical Movement.

This ingenious piece of mechanism, described in our last week's issue, was recently patented by Mr. Joseph Harris, Jr., of Harrison Square, Boston, Mass. By some mistake we omitted the inventor's address in the article referred to.

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STENCIL COPYING PROCESS.

By the following process one thousand or more copies of writings or drawings may be obtained with the gelatine tablet.

Fine linen or bank-note paper is coated over on one side by means of a camel-hair varnish brush, with a clear solution of one ounce of pine resin in four ounces of absolute alcohol. When this coat has dried another is put on.

The ink used on this prepared paper is prepared from—

Water	1 ounce.
Caustic potash	1 "
Vandyke brown, to color	q. s.

The writings or drawings are executed with an ordinary pen on the coated side of the paper. The paper is then floated on the surface of clear water, written side up, with care to avoid wetting the upper side. In about ten minutes the lines will appear swollen, and then the paper is taken out by one corner and placed, writing downward, on a blotter. The back of the paper having been washed over with a camel-hair brush filled with water, the paper is turned on the blotter and washed in a similar manner until the ink disappears; the sheet is then dried between blotters, when it is ready for use.

The tablet composition is prepared by dissolving by aid of heat over a salt water bath one ounce of Cooper's gelatine, previously softened by soaking it in a little cold water over night, in six ounces of best glycerine, and pouring the solution out in a shallow tin pan. This pan may be half an inch deep, ten inches wide, and fourteen inches long. When the composition is poured in it should stand level, and should remain in this position for twelve hours. The surface of the tablet should be sponged over with cold water and dried before using.

Place the stencil paper, written side down, smoothly upon the tablet, and with a small paste brush paint over the back of the paper with an ink prepared from—.

Aniline violet, best	1 ounce,
Glycerine, pure	1 "

by triturating them together in a hot mortar and allowing the ink to stand for twelve hours or more before using it.

Place over the inked sheet another (blank) sheet of the prepared paper, rub the hand firmly over it, and put a weight of two or three pounds on it; a book or smooth board with a quantity of printing paper beneath it does very well.

In about half an hour this weight may be removed and the stencil paper carefully separated from the tablet, leaving a strip of half an inch of it adhering at the side and turning the sheet over the edge of the pan, as shown in the illustration.

If the manipulations have been properly conducted a reversed copy, in the aniline ink, will be found on the tablet, and from this a large number of positive copies may be obtained in the usual manner—by spreading a blank sheet of paper on the tablet and passing the hand gently over the paper.

When the print becomes faint the stencil may be folded over and pressed against the tablet as before, the adhesion of the edge of this stencil securing, with a little care, proper registration and the rubbing re-enforcing the transfer. A few minutes is all that is required for this re-enforcing.

STENCIL COPYING TABLET.

The stencil should be turned back on a cardboard, keeping the blank sheet under it.

This stencil paper is semi-translucent, so that in copying drawings, wood engravings, etc., it may be used as a tracing paper.

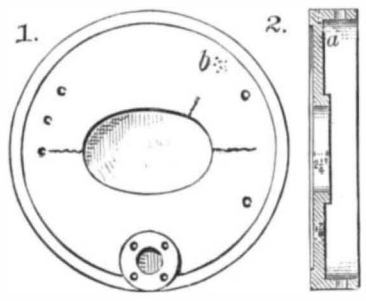
In floating the stencil on the water care should be taken that no air bubbles are left under the paper.

INTERESTING TEST OF CAST IRON BOILER HEADS.

Messrs. Sidebotham & Powell, proprietors of the Frankford Boiler Works, in Philadelphia, the firm who made the exploded Gaffney & Co. boiler, that was illustrated in the SCIENTIFIC AMERICAN of July 9, 1881, having been censured by certain local experts for having made a poor boiler for Gaffney & Co.—hence the explosion—determined to test a short model section made in the same manner by bursting it with hydrostatic pressure.

The experiment was made on the afternoon of July 13, at their works, Frankford Road, in the presence of a large number of invited mechanics, manufacturers, and experts, among whom were inspectors of the city and of the Hartford Insurance Company, and nearly all the coroner's jury whose late verdict made such a sensation in Philadelphia, on account of its virtual condemnation of flat cast iron heads

The tested boiler was composed of a single plate of No. 3 boiler iron of the best quality, single riveted, in the form of a hollow cylinder, 42 inches long by 36 inches diameter, having two flat cast iron heads, one of which had the same sized man hole and the identical plate that blew out of the Gaffney & Co. boiler. The number and size of the holes were the same as in the exploded boiler head, which was cast from the same pattern. A hand pump used by the city inspectors was used to force in water. In addition to the holes that were in the exploded head one was made at *b* and a plug inserted to stop a leak. When the pressure reached 450 pounds per square inch the head having the man hole gave out, without noise or shock, by cracking on lines each side of the man hole opening on the large axis of the oval six inches each way, and another radial crack about two inches long at the upper right hand curve, thus:



The head was then taken out after unsuccessful attempts had been made to complete the breaking of it by sledges, and an examination of the inside showed a circular crack near the angle of the flange at *a*, extending one-third or more round the circle. The breaking up of the casting was then completed to compare the texture of the metal with that of the old head, which was at hand for the purpose.

The result indicates that cast iron has still some reliability as a material for boiler heads. This sample that gave out was not more perfect than the Gaffney head; in fact it showed pin-hole leaks at *b*, Fig. 1, when the pressure reached about 200 pounds, and a number of defects were seen in the circular fracture. The outward deflection of the unbroken head at the other end of the cylinder was noted and found to be three-sixteenths of an inch outward bulging at the center.

This test was, in the minds of all unprejudiced persons who saw it, a complete vindication of Messrs. Sidebotham & Powell, and goes to show that both their work and their judgment were good. The ultimate strength of the weakest part of this experimental boiler being 450 pounds, the rule that allows a factor of one-fifth would give 90 pounds as the safe working load for it. The whole indicates that the pressure on the Gaffney boiler was something enormous at the time of the explosion, as no shock is believed to have taken place.

The Philadelphia *Record* gives the following particulars:

"When everything was in readiness the pressure was applied. The usual seeping at the rivets was apparent when the gauge registered 105 pounds, but beyond this the boiler did not exhibit any symptoms of a strain. At 130 pounds the water began to ooze through a small sand-hole in the head, above the man-hole, showing that the head was slightly defective. The pressure was then reduced, while Inspector Overn affixed a contrivance to the rear end for the purpose of measuring the extent of expansion. Pressure was again applied until the gauge marked 140 pounds, then 160, 180, and 200. At this moment of pressure the seams on the side of the boiler began to weaken, and from one spot a spray of water as fine as steam was discharged. At 250 pounds this had increased to a good-sized squirt, and at 350 the water was issuing with such force as to be thrown four feet away. Still the heads remained intact. At 400 pounds half a dozen similar fissures appeared in a close row in the same seam. The pressure was then gradually increased to 425 pounds, and the lookers-on were beginning to wonder whether the boiler would hold out forever, when a sudden crack was heard in the front head, and the water commenced to run down from a fissure extending half way across the head. The gauge showed that the boiler had given out at a pressure of 450 pounds. Had it not been for defects, the head would probably have stood an additional 50 pounds pressure before giving way. The measurements taken by Inspector Overn showed that the rear head had expanded one-sixteenth of an inch at 200 pounds, and three-sixteenths at the time of the break.

"The members of the Coroner's jury had little to say concerning the result. Three of the five sat some distance away while the pressure was being applied, and apparently took but little interest in the proceedings. Before leaving they held a short confidental consultation, in the course of which one remarked: 'This is no reflection on us. If we undertake to answer it we shall never be done of the subject.' 'Yes,' responded another, 'we would start a discussion which would never end.' Several of the jurymen, when asked to give their opinion of the experiment, emphatically declined to express themselves on the subject.

"Several weeks ago, when the Hartford Company decided not to pass any boilers with flat cast-iron heads over 32 inches in diameter, City Inspecter Overn addressed a communication to City Solicitor West, asking what authority, if any, the City Inspector could exercise in the same direction, and also requesting advice as to how he should govern himself in passing upon steam boilers. In reply, the City Solicitor says that the questions are more fitted for a mechanical expert than for a lawyer, but that legally he would advise the inspector when, in his judgment a boiler is safe, to approve it and give a certificate, without regard to its mode of construction or the material used. Mr. Overn has consequently decided to adhere to his usual practice of passing all boilers with the obnoxious heads if they have safely withstood the cold water test."

The American Institute and the Atlanta Cotton Fair.

To facilitate the transportation and care of exhibits from this region for the Atlanta International Cotton Exposition, the Board of Managers at Atlanta have authorized a committee of the Farmers' Club of the American Institute to arrange for a "collective exhibit" comprising a variety of subjects. This gives to manufacturers and others who do not care to go to the expense of making an individual exhibit to have their goods shown there at a nominal expense.

The committee will meet at the Cooper Union every Tuesday at 1:30 P.M., and the members may be consulted at their respective addresses as below:

J. M. Jones, Chairman, 48 South Oxford St., Brooklyn; Dr. I. P. Trimble, Entomologist, 15 West 31st St., New York; Prof. A. R. Ledoux, 17 Cedar St., New York; Dr. A. S. Heath, Pres. Farmers' Club, 945 Lexington Ave., New York; N. S. Bailey, Secretary, 192 Water Street, New York.

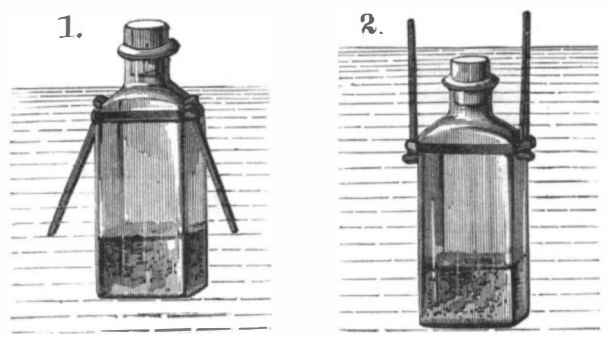
It is desired that all applications be made by August 10, that ample space may be secured. The exposition opens Oct. 5, and closes Dec. 31, 1881.

A LIFE-SAVING LESSON IN PHYSICS.

It is a well-known fact that any person of average structure and lung capacity will float securely in water if care is taken to keep the hands and arms submerged and the lungs full of air. Yet in most cases people who are not swimmers immediately raise their hands above their head and scream the moment they find themselves in deep water. The folly of such action can be impressively illustrated by means of a half empty bottle and a couple of nails; and the experiment should be repeated in every household until all the members—particularly the women and children—realize that the only chance for safety in deep water lies in keeping the hands under and the mouth shut.

Any short-necked, square-shouldered bottle will answer, and the nails can be easily kept in place by a rubber band or a string. First ballast the bottle with sand, so that it will just float with the nails pointing downward, as shown in Fig. 1; then by turning the arms upward, as shown in Fig. 2, the bottle will be either forced under water at once or will be tipped over so that the water will pour into the open mouth, and down it will go. To children the experiment is a very impressive one and the moral of it is easily understood.

The vital value of this precaution was strikingly illustrated near Accomac C. H., Virginia, a few days ago. A niece of the Hon. John Neely, while bathing, was swept off into the ocean by a strong current and soon disappeared in the high breakers. As she could not swim her companions gave her up for lost. Two young fishermen who were employed some distance away thoughtfully set out with a small boat in search of her, and, when a mile or more from shore,



found her floating on the water. She had been drifting nearly an hour and was greatly exhausted, but soon recovered. Unable to swim she had pluckily floated, thereby making her rescue possible.

A Cheap Binding for the Scientific American.

A correspondent says:

I have bound about twenty volumes in this way: Pack the papers smoothly; hold firmly, and drive a thin chisel through the pile about half an inch from the back. Push strong tape through and leave out about two inches; put three or four tapes through at even intervals. Cut common thick paper boards large enough to project a little everywhere except that one edge must come front of the tapes. Draw the tapes tightly and *glue* down to the boards outside. Skive a piece of leather—common sheepskin will answer—wide enough to cover the back and come on the boards an inch or two, and long enough to project a couple of inches at the end. Paste the leather well, put it on the back; fold the ends in so as to come over the boards on each side. Paste any fancy or plain paper over the sides; and, lastly, paste the blank leaf down to the cover inside, and you have a very presentable book and very durable. Trimming the edges is not very essential, as the SCIENTIFIC AMERICAN is now trimmed, but that can be done by clamping between boards, and cutting the edges with a thin sharp knife by a straight edge. Of course this is done before the boards are put on after the tapes are in. This makes a flat edge book, but for a thin book answers very well. S. H. B.

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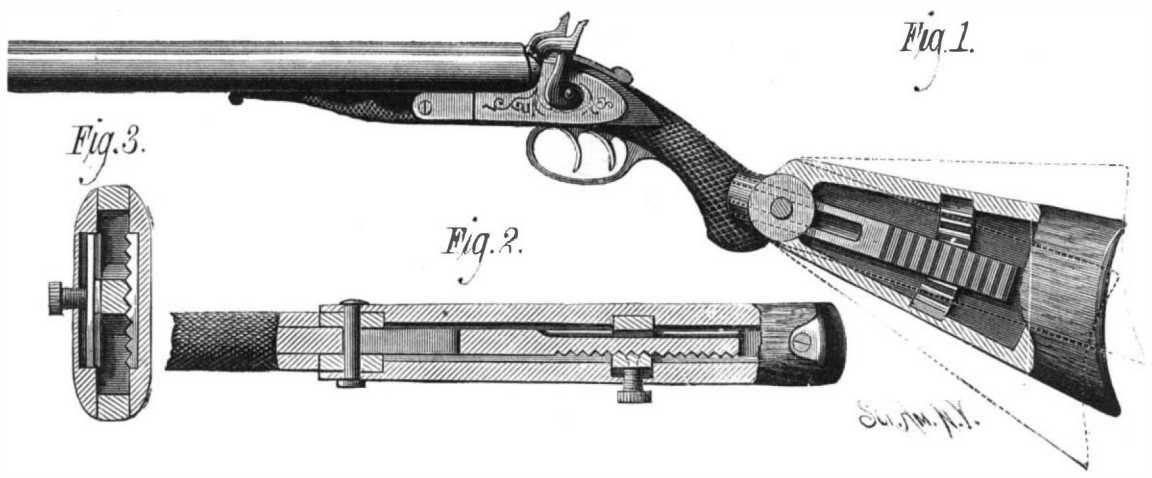
NEW ADJUSTABLE GUN STOCK.

The engraving represents an improvement in gun stocks recently patented by Messrs. A. Hape and A. S. Oliver, of Elberton, Elbert county, Ga. This stock can be adjusted to any desired inclination, and it may be lengthened or shortened as may be required. Figure 1 is a side view of a stock showing different positions in dotted lines; Figure 2 is a horizontal section showing the relation of internal parts, and Figure 3 is a vertical transverse section.

A slotted extension projects from the end of the grip, and enters the hollow stock. At the smaller end of the stock there is a joint which slides upon the extension, and is capable of being fastened at any desired point. The extension has upon one of its sides longitudinal ribs which are engaged by a ribbed sector embedded in the stock, and serve to adjust the angle of the stock by placing the ribbed extension at different points on the sector. Upon the other side of the stock there is a ribbed plate which is the counterpart of the transversely ribbed surface of the extension. This plate is clamped tightly against the extension by a screw whose head is outside of the stock. By loosening this screw the stock may be extended or moved up or down as circumstances may require, adapting the gun to the tastes or necessities of the user.



ADJUSTABLE GUN STOCK.

American Dental Association.

The twenty-first annual convention of the American Dental Association began in this city July 12. The seventy-five delegates present included many of the more prominent dentists of the country. In his address Professor C. N. Pierce, of Philadelphia, discussed the professional and legal standing of the science of dentistry, its recent advances and prospects, and the need of fuller medical education on the part of dentists. He regretted that the medical profession had never appreciated the requirements of dentists, and that the medical colleges granted degrees in dentistry without insisting on a sufficient study of general medicine. The obstetrician and the surgeon were compelled to take a full course of medicine, and receive the degree of M.D., before they could be recognized in any of the specialties. He thought that the practice of dentistry required just as careful an education as the branches of medicine did, and therefore inferred that the medical profession should give the subject more attention.

A NEW USE FOR THE INDUCTION BALANCE.

BY GEO. M. HOPKINS.

The form of induction balance devised by Professor Hughes, of London, already has several interesting and useful applications, and a new use for it is now suggested by the recent tragedy at Washington. It seems essential to locate the bullet in the body of the President.

The induction balance is a most delicate electrical instrument for detecting the presence of metals, and a modified form of it could be easily applied to this purpose with a reasonable expectation of success. This instrument consists of two short glass cylinders, around each of which are wound two parallel coils of fine insulated copper wire. One coil of each pair is included in a battery circuit in which there is a clock microphone. The other pair is placed in a closed circuit with a receiving telephone. The two glass cylinders, with their encircling coils, may be widely separated. The induction set up in the secondary or telephone circuit is balanced by the reversal of one of the secondary coils and so adjusted that the induction in one of the secondary coils exactly balances or neutralizes the induction in the other, so that when the ear is applied to the receiving telephone no sound is heard.

Now by placing ever so small a piece of metal in one of the glass cylinders the electrical balance is disturbed and the clock on the microphone is heard to tick loudly, thus indicating the presence of metal—and the same is true if the coil be placed in the vicinity of a piece of metal.

It occurred to me to try the effect of a lead bullet upon the instrument, placing it at different distances and separating it from the coil by insulating material, but I found that the ordinary microphone with carbon electrodes was entirely useless, inasmuch as a very strong current is required to get results from lead, which of all metals, unfortunately, produces the least effect on the instrument. As a strong current burned the carbon of the microphone, I devised a current interrupter operated by a clock which interrupted the current at regular intervals and insured uniform results. With this current breaker the result exceeded my anticipations, as with a set of coils that were by no means sensitive I was able to locate the bullet with the coils raised a vertical distance of nearly two inches. I suggested to Mr. J. Stanley Brown, the President's private secretary, that, by passing a pair of coils over the President's back and abdomen, the bullet might be located, and that by making comparative tests the depth of the bullet might be ascertained.

At the request of the secretary my apparatus was sent to Washington, but nothing can be said at present in regard to the success of the experiment.

If the missile were of iron or steel no difficulty would be experienced in locating it at a depth of four to five inches, but being lead, it is questionable whether it will disturb the electrical balance at a greater depth than two inches.

The diagram shows the arrangement of battery, microphone, and primary and secondary circuit wires.

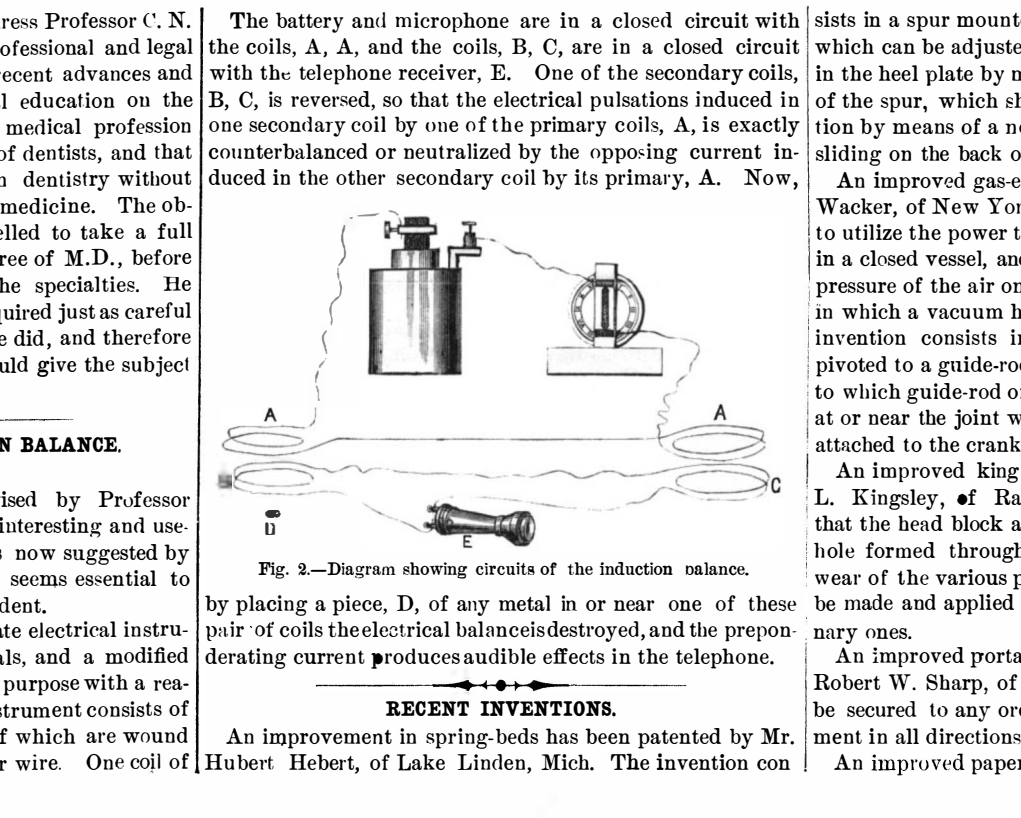


Fig. 1.—THE INDUCTION BALANCE USED AS A BULLET FINDER.

The battery and microphone are in a closed circuit with the coils, A, A, and the coils, B, C, are in a closed circuit with the telephone receiver, E. One of the secondary coils, B, C, is reversed, so that the electrical pulsations induced in one secondary coil by one of the primary coils, A, is exactly counterbalanced or neutralized by the opposing current induced in the other secondary coil by its primary, A. Now,

Fig. 2.—Diagram showing circuits of the induction balance.

by placing a piece, D, of any metal in or near one of these pair of coils the electrical balance is destroyed, and the preponderating current produces audible effects in the telephone.

RECENT INVENTIONS.

An improvement in spring-beds has been patented by Mr. Hubert Hebert, of Lake Linden, Mich. The invention consists in a spring-bed formed of a series of slats resting on crossed inclined spring-slats, the outer lower ends of which are fastened to the longitudinal side bars of a base-frame. The middle of these spring-slats is supported by two adjustable longitudinal rails passing through the middle of the base-frame, by means of which middle rails the elasticity of the spring-slats can be adjusted.

Mr. J. Paris Dunn, of Brooklyn, N. Y., has patented an improved railroad signaling mechanism. The object of this invention is to provide a device especially adapted to elevated and other railroads, where the stations are but a short distance apart, for announcing to approaching trains whether the track is clear or occupied, and thereby to prevent all collisions.

An improved package or receptacle in which granulated or lump bluing can be placed for transportation or use, has been patented by Mr. Daniel Dunscomb, of New York City. The invention consists of two hemispheres, preferably of metal, fitted to or upon each other so as to form a sphere, which is suspended so that it can rotate from a handle of wire or other suitable material that enters centrally into the upper hemisphere, and has its entered end bent or looped so as to form a stirrer for agitating the contents of the receptacle.

An improved compound for removing paint has been patented by Mr. Herman Gasser, of Platteville, Wis. The object of this invention is to provide for the use of painters or others a solvent compound for softening or dissolving old or hardened paint preparatory to washing off or removing the same from glass, wood, or other surfaces to which it may have been applied. The compound is formed of a solution of a caustic alkali with a gelatinous solution of starch.

An adjustable spur for the heel of a boot or shoe for enabling persons to walk on ice or icy surfaces without slipping, has been patented by Mr. Charles E. Friel, of Fredericton, New Brunswick, Canada. The invention consists in a spur mounted on a shaft in a recess in the heel, which can be adjusted to project through a transverse slot in the heel plate by means of a crank attached to the shaft of the spur, which shaft can be locked in any desired position by means of a notched slide fitting over this shaft and sliding on the back of the heel.

An improved gas-engine has been patented by Mr. George Wacker, of New York City. The object of the invention is to utilize the power that is obtained by the explosion of gas in a closed vessel, and to utilize the power produced by the pressure of the air on a piston at the outer end of a cylinder in which a vacuum has been formed by an explosion. The invention consists in a gas-engine having its piston-rod pivoted to a guide-rod pivoted to the frame of the machine, to which guide-rod one end of the connecting-rod is pivoted at or near the joint with the piston, whereas the other end is attached to the crank of the fly-wheel.

An improved king bolt has been patented by Mr. Horace L. Kingsley, of Racine, Wis. The construction is such that the head block and axle are not weakened by having a hole formed through them to receive the king bolt, the wear of the various parts is lessened, and the fixtures can be made and applied to the vehicle at less cost than the ordinary ones.

An improved portable head rest has been patented by Mr. Robert W. Sharp, of Brooklyn, N. Y. This head rest can be secured to any ordinary chair, and is capable of adjustment in all directions.

An improved paper bag has been patented by Mr. Charles A. S. Lockwood, of Haverstraw, N. Y. The object of this invention is to facilitate the manufacture of paper bags and economize the use of stock in their construction.

An improved lever button has been patented by Mr. Willis H. Howes, of New York city. The object of this invention is to facilitate and cheapen the construction of lever buttons. The invention consists in the combination with the hinge or joint connecting the elastic posts of the head and the shank of the shoe, of interlocking teeth, whereby the shoe will be held securely when parallel and when at right angles with the head without a separate spring.

A magnetic support for scale beams has been patented by Mr. Solomon H. Brackett, of St. Johnsbury, Vt. This invention relates to beam or even balance scales, or other scales depending on pivoted levers. The main feature of this invention consists in the combination, with the pivotal beam or lever, of a magnet arranged to attract the central or pivotal part of the beam and suspend it against the action of gravity.

An improved velocipede has been patented by Mr. Alfred J. Harrison, of Parkville, Conn. The invention consists in constructing one or two of the three driving gear-wheels of a tricycle with revolving teeth, that the fixed toothed wheel or wheels geared with them may move with less friction.

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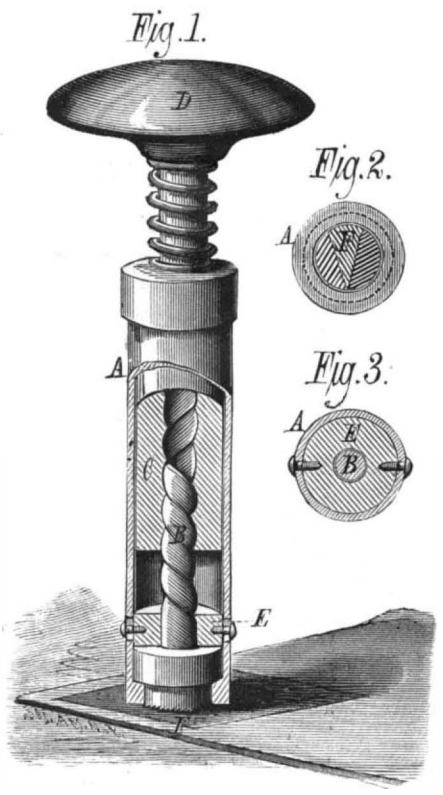
IMPROVED CANCELING STAMP.

Without doubt the amount lost by the government yearly from the reuse of canceled postage stamps is enormous, and so far no adequate means of canceling stamps, so that they cannot by any possibility be used again, has been adopted by the government.

A device which will effectually cancel a stamp by abrading its surface is shown in the annexed engraving. The



GROTHAUS' CANCELING STAMP.

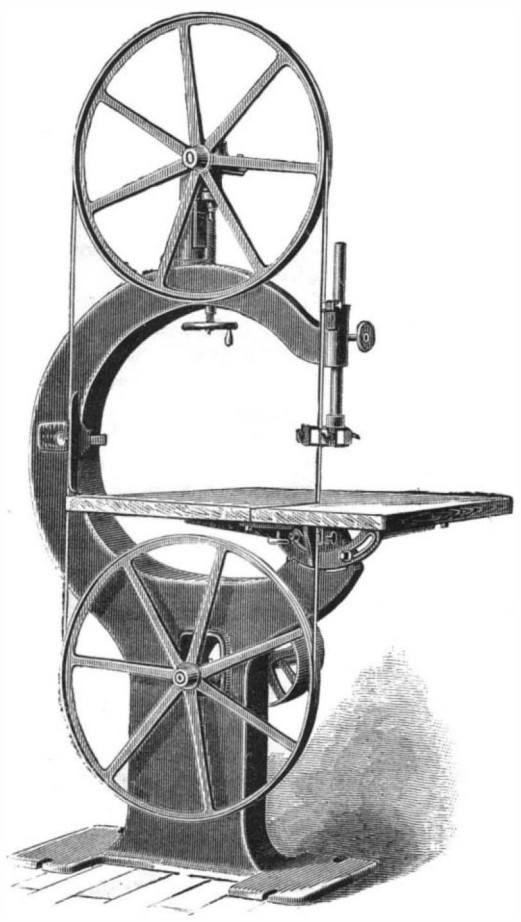
handle or body, A, of the canceler contains a sliding nut, C, which is attached to the handle, D, and receives the screw, B, attached to the revolving cutter head, E, which is retained in place by an internal flange at the bottom of the handle and by an inserted collar, E.

Between the handle, D, and the top of the case, A, there is a spiral spring which returns the parts to their normal position. The cutting head, which is shown in detail in Fig. 2, is cut like a file in different directions, so that when the head is revolved by the engagement of the nut, C, with the screw, B, the surface of the stamp is abraded, and if the canceling stamp is previously supplied with ink, the ink will be absorbed by the abraded surface, and the effects of cancellation are complete. The stamp cannot afterward be restored.

This invention was recently patented by Mr. Frederick E. Grothaus, of Borem, Texas.

NEW BAND SAW MACHINE.

This machine is new in design, and is adapted to the various requirements of a good tool of this size. The metal



CLEMENT'S BAND SAW MACHINE.

is distributed so as to obtain great strength in the arch, while the supporting parts of the frame are made comparatively light. The wheels have improved concave arms, and are carefully turned and balanced, and covered with pure rubber. The bearings are extra long on both shafts, and lined with a good quality of Babbitt metal. The upper wheel is made adjustable to strain the saw, and it is also adjustable across its axis to shift the saw upon its face; it is cushioned on the straining screw to compensate the contraction of the saw in cooling. The guides are of hardened steel, adjustable in every direction. The loose pulleys are self-oiling, and have extra long hubs. The shafts are of steel, and the table is made of kiln-dried hard wood, unless otherwise ordered, is arranged to tilt to an angle, and has the clamp bar across the slit.

This size is adapted to pattern, carpenter, bracket, toy, cabinet, carriage, and general work, and to the lighter grades of sawing in all wood shops. It will carry blades to five-eighths of an inch in width, No. 22 gauge.

Every machine is furnished with a wrench, scarfing frame for holding the saw while soldering, and with tongs for melting the solder.

This tool is a favorite among pattern-makers, and well adapted to sawing of the lighter kind.

There are four sizes of the machine made. The particular one illustrated is known as the twenty-eight inch band saw machine. We give its dimensions below:

Extreme height, 7 feet 1 inch; floor room, 3 feet 2 inches by 4 inches; table surface, 30 by 34 inches; sawing space, 10 by 28 inches; pulleys, 10 by 3¼ inches; diameter of wheels, 28⅜ inches; revolutions, 500 to 550; length of saws 16 feet; shipping weight 675 lb.

These machines, in their various sizes and with all improvements, are made by Mr. Frank H. Clement, 122 Mill street, Rochester, N. Y.

Mortality of Brakemen.

The brakemen on our railroads find it quite difficult to get their lives insured. It is estimated that there are at least ten brakemen killed throughout the country every day. The reader of the daily newspaper learns how this class of men are killed or maimed while coupling cars and making up trains, while others are knocked from the tops of cars by bridges, or slip or fall, or are injured or killed in collisions. Then there must be at least three times as many brakemen injured as are killed, of whom the public knows nothing about or gets no account.

At the lowest calculation, if 10 brakemen are killed every day, that would be equivalent to 3,650 during the year, which, added to the number injured in various ways while on duty, would give the sum total of deaths and injuries about 14,600 a year These are frightful figures of a fatality, a loss of life, or injury to the body, that is attributable either to accidents, carelessness, or negligence.

We therefore venture to assert that it is a fact that the public has no idea of the number of accidents that occur on the various railroads throughout the country every day; and it is also true that there is no vocation so fraught with danger to life and limb as that of the brakemen on our railroads, particularly on freight trains, men on passenger trains having a great many lives intrusted to their care, and, consequently, have a greater responsibility resting upon them than that which rests with the freight men.

Indeed the life of a freight brakeman is a precarious one. Some insurance agents, in some parts of the country, do not take risks on employés on freight trains; but conductors and brakemen on passenger trains are insured by their paying an extra per cent. Railroad men say that only about 25 per cent of the brakemen of freight trains die a natural death; also, that the average life of the brakeman, after he goes on the road, is about ten years.—*Boston Commercial Bulletin.*

The New Chesapeake Bay Lighthouse.

What is regarded as one of the finest lighthouses in the world is being erected in Chesapeake Bay, off Cape Henry. From base to top it measures 155 feet, with a diameter at the base of 30 feet and at the top of 16 feet. There are six stories, above which are a service room, watch room, lantern room, and finally the roof. Its total weight is 1,700,000 pounds, 7,000 pounds of bolts alone being required to put it together. The exterior, which is octagonal in shape, is constructed of cast iron, while the cylindrical interior is of sheet iron. The castings of the base and first story are two inches in thickness, and the sheet iron lining ⅜ of an inch. The staircase, which has iron sill steps, goes around the cylinder instead of up a shaft as in the lighthouses now in existence. The "light room" is a circular steel frame 12 feet in diameter and 9 feet high. The glass to be used is now being manufactured in France, and a light of great power will be adopted. Every story is solidly bolted together by heavy cast iron floor plates 1½ inches thick, while the points and facings are finely planed, four planers having been kept running day and night for the entire eighteen months. So closely are the plates fastened together that from the outside each story looks like a solid piece of iron. The base and windows are elaborately ornamented with castings, while a handsome iron railing surrounds the watch room. Many of the bolts are 1¾ inches in diameter at one end, and ⅞ of an inch at the other. The iron work was furnished by Messrs. Morris & Trasker, Philadelphia.

Tin in the Sierra Madre, California.

The *Commercial*, of Los Angeles, Cal., reports that an assay of tin ore from the mine discovered near Pomona, showed a result of $89.70 per ton in tin This mass of tin ore has hitherto been mistaken by prospectors for common rock stained with iron.

IMPROVED DIVIDERS AND CALIPERS.

The engraving represents an improvement in dividers and calipers, recently patented by Mr. Edward Soetbeer, of New Bremen, O. The invention consists in the adjusting device, which is arranged so that the instrument may be opened or closed and held firmly in any desired position. A swiveled bearing in one leg of the instrument and a swiveled nut in the other leg receive the adjusting screw, which is

SOETBEER'S CALIPERS.

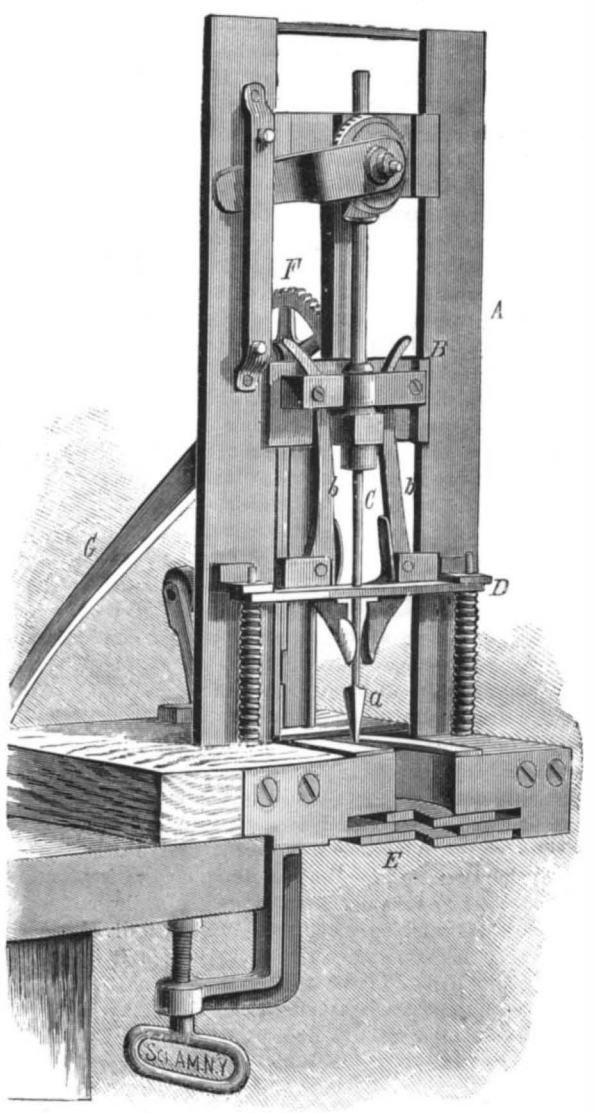
prevented from longitudinal movement by a circumferential groove in the shank of the screw, and a pin extending through the bearing and through the groove in the screw.

It will be seen that by this construction the bearing and nut of the screw are always parallel to each other, and the adjustment of the instrument is positive.

Further information may be obtained by addressing the inventor as above.

NOVEL CORK EXTRACTOR.

We give an engraving of a novel cork extractor lately patented by Mr. Chester C. Clark, of Brownwood, Texas, and designed for drawing corks from bottles containing champagne, beer, ale, mineral waters, etc. It is to be attached to



CLARK'S AUTOMATIC CORK EXTRACTOR.

a table, shelf, or counter, and is operated by the lever handle, G, projecting from the back of the apparatus.

The bottle from which the cork is to be extracted is placed between the jaws. E. which close and hold it securely when

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the lever, G, is raised to drive the harpoon head, *a*, downward through the cork. The lever, G, has its bearings in a cross piece of the frame, A, and carries a segmental gear wheel, F, that engages a rack on the back of the slide, B. A shaft journaled in this slide carries at its lower end the extracting instrument, *a*, and is provided with a pinion near its upper end that is engaged by a bevel wheel journaled on the slide, B, and carrying an arm that extends laterally and between two stops on its frame, A.

Two bill-pointed levers, *b*, are pivoted in a cross bar, D, and extend upward through guides in the lower portion of the slide, B. The bar, D, slides upon two rods projecting vertically from the bed of the machine, and is supported by spiral springs.

The operation of the machine is as follows: The bottle being in position between the jaws, E, the lever, G, is to be raised to nearly a vertical position, forcing the blade, *a*, into the neck of the bottle, severing the wires which secure the cork, and cutting the cork in two in the center. Just as the blade passes through the cork the end of the lateral arm on the bevel wheel strikes the lower stop on the frame, A, and turns the blade, *a*, one quarter around. The lever, G, is now brought down, elevating the sliding frame and blade, and lifting the cork from the bottle. Before the frame reaches its highest point the end of the lever on the bevel wheel, G, comes against the upper stop, causing the blade to be turned to its original position, and at this time the jaws, E, release the neck of the bottle. The two bill-pointed levers, *b*, divide the cork and expel it in two parts away from the blade by the lateral motion imparted to the levers by the engagement of the curved ends by the guides on the slide, B.

This machine is very simple and rapid in its operation, and should find a large use in hotels, restaurants, and other places where a large number of bottles are opened.

PREPARATION OF TINNED IRON—TIN PLATE.

Pure tin melts at a temperature of 424° Fah., and when iron, thoroughly cleansed from oxide and other impurities, and heated somewhat above this temperature, is plunged into the melted metal and allowed to remain there for a time it receives and retains a coating of the white metal. The chief difficulty in this plating process is to get the surface of the metal properly cleansed. The process of tinning sheet iron as usually conducted will show how this is accomplished. It is briefly as follows: Charcoal iron of the proper thickness is cut into rectangular pieces of the required size—usually from 12¾x9½ to 16¾x12½—and bent U-shaped so as to stand on edge. The plates are then placed in an acid pickle, usually of diluted sulphuric acid, though sometimes hydrochloric acid is preferred. In Pittsburg a hot 10 per cent solution of sulphuric acid is employed, and the pickling operation continued for about twenty minutes. From the pickle the plates are transferred to a closed annealing muffle or oven heated to redness, where they remain for about six hours and scale or free themselves from oxidation, when they are allowed to cool, and are then straightened and cold-rolled between polished steel rollers under great pressure, which imparts smoothness and elasticity. After this the plates are usually again annealed for six or seven hours, at a much lower temperature than before. Then follows a second pickling—in warm dilute sulphuric or muriatic acid—for about ten minutes, and in some cases a slight scouring with sand and hemp. After quickly running through water from the last operation they are plunged into melted tallow (free from salt) or palm oil, and when the moisture has been driven off by the hot grease or oil and the plate itself has become thoroughly heated it is ready for the first dip in the tin.

The series of pots in which the tinning operation is performed are placed together on a low brick furnace called by the workmen the "stow." These pots are usually of cast iron. The first, the *tin pot*, is rectangular in shape, and holds about five hundred pounds of block and grain tin, on which floats about four inches depth of pure tallow to prevent oxidization of the metal. The furnace envelops the sides and bottom of this vessel. Alongside this is the grease pot. The *wash pot*, similar to but smaller than the *tin pot*, which it adjoins, is nearly filled with best grain tin, and is provided with a partition to prevent dross gathering at the point at which the last dip is given to the plates. The next vessel is called the *pan*, and is used for draining the plates; it has a grating at the bottom and no fire under it. The last vessel, the *test pot*, has only about one-quarter inch depth of tin in it.

The operation of tinning the plates is as follows: Each plate is lifted singly from the *grease pot* and stood on edge in the tin pot and allowed to remain immersed in the hot tin for about twenty minutes. (The *tin pot* is always kept nearly full of plates.) When lifted out the plate is allowed to drain for a moment, and is then changed to the first division of the *wash pot* for a few minutes, on leaving which it is brushed with hemp, dipped in the second division of the pot, and allowed to drain for a few minutes in the pan. The thick edge or list is removed by momentarily dipping it (the edge) in the hot tin contained in the *list pot* and jarring the plate. After this the plate is returned to the *grease pot* for a few minutes, from which it is drawn out between rollers which smooth and straighten the plates. They are finally cleaned by rubbing them with shorts or bran and leather, sorted, and boxed—each box of I.C. plate containing 112 pounds or 112 plates, the plates having a gauge of No. 30, and weighing one pound each. I.X. brand weighs 140 pounds to 112 sheets.

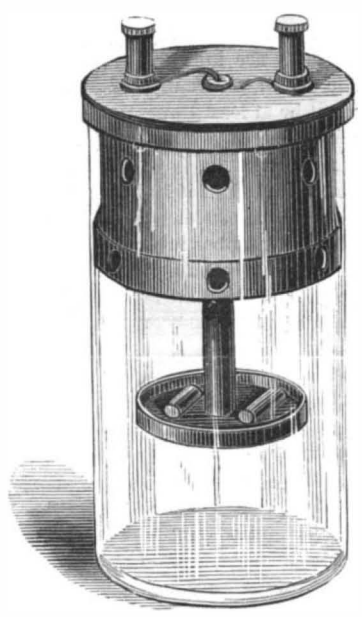
In the trade the grade, weights, and sizes of the plates are indicated by certain marks, as shown in the following table:

Names.	Sizes—Inches.	Number in a box.	Weight in a box—Pounds.	Box Marks.
Common No. 1	13¾x10	225	112	CI.
" No. 2	13¼x 9¼	225	105	CII.
" No. 3	12¾x 9½	225	100	CIII.
Cross No. 1	13¼x10	225	140	XI.
Two Cross No. 1..... .	13¼x10	225	161	XXI.
Three Cross No. 1.....	13¼x10	225	182	XXXI.
Four Cross No. 1. ...	13¼x10	225	203	XXXXI.
Common Doubles.....	16¾x12½	100	77	C.D.
Cross Doubles	16¾x12¼	100	126	XD.
Two Cross Doubles ...	16¾x12¼	100	174	XXD.
Three Cross Doubles ..	16¾x12¼	100	168	XXXD.
Four Cross Doubles....	16¾x12¼	100	189	XXXXD.
Common Small Doubles	15 x11	200	168	C.S.D.
Cross Small Doubles...	15 x11	200	189	XSD.
Two Cross Doubles...	15 x11	200	210	XXSD.
Three Cross Doubles ..	15 x11	200	231	XXXSD.
Four Cross Doubles..	15 x11	200	252	XXXXSD.
Wasters Common No. 1	13¾x10	225	112	W C.I.
Wasters Cross No. 1...	13¾x10	225	140	WXI.

MAICHE'S BATTERY.

The inventor of this entirely original form of battery, of which we give an illustration, has endeavored to fulfill all the conditions necessary to make his battery work for an indefinite period, and this ideal result is obtained—thanks to the means of depolarization which he employs.

A porous vase, pierced with large holes, is fixed to an ebonite cover, which closes an earthenware vase filled with retort carbon, broken in pieces and platinized. The porous vase is traversed by an ebonite tube supporting a small porcelain cup, in which is placed a small quantity of mercury and two small pieces of zinc. A platinum wire, connected to a terminal fixed on the cover, dips into the mercury, and establishes a good contact with the zinc.



MAICHE'S BATTERY

Another platinum wire connects a second terminal with the carbon fragments placed in the porous vase. The contacts are thus completely assured. The zinc is not attacked, except when the circuit of the battery is closed; it is plunged entirely in the liquid, consequently it is entirely used up without any loss.

Under the influence of the platinized carbon the hydrogen of the water, which tends to polarize the carbon, combines with the oxygen of the air. That this novel effect, sought for in vain for a long time, can take place, the carbon should only be partially immersed in the water; the rest becomes wetted by capillary action, and presents a considerable surface to the air.

The water produced by the combination of the hydrogen and the oxygen contributes, to a certain degree, to replace that which passes off by evaporation, and which the cover keeps from being lost.

The electromotive force of this battery is about 1·250 volts; but it is necessary to work it through an external resistance of about 3 kilometers of ordinary telegraph wire in order that it may work well. The exciting liquid may be water saturated with sal-ammoniac, or acidulated by sulphuric acid, or the bisulphate of soda, in the proportion of 10 to 1.

An element working a bell about 100 times a day would not require to be looked after for a very long time, and, in this case, it would only be the zinc that would require replacing, as the platinized carbon preserves indefinitely its catalytic properties.

The Maiche battery is particularly well adapted for electric bells. Maintenance not being required, its fitness and the care taken in its whole construction make it the most perfect bit of apparatus of its kind.—*L'Electricité.*

American Philological Society.

The thirteenth annual meeting of the American Philological Society began in Cleveland, Ohio, July 12, with about thirty members in attendance. The papers and discussions of the first day embraced "Homer and Strabo," by Prof. Egrihler, of Johns Hopkins University; "Latin Words in the Talmud," by Prof. James S. Blackwell, of the University of Missouri; and "The Home of the Original Semitic People," by Prof. Loy, of Howard University. In the evening the annual address was delivered by Prof. Lewis R. Packard, President of Yale College.

On the second day papers were read as follows:

"History of the 'A' vowel, from old Germanic to Modern English," by Dr. W. Weelsey, of the Johns Hopkins University, Baltimore; "Verses of Text respecting the Precious Stones of Scripture," by Prof. Blackwell, of the University of Missouri; "Mixture in Language," by Prof. W. D. Whitney, of Yale College; "Language of the Isle of Man," by Mr. W. S. Kerruish, of Cleveland; "The Use of Abstract Verbal Nouns in Thucydides," by Dr. E. G. Sihler, of New York; "The Vowel Scheme of Melville Bell," by Prof. Samuel Porter, of the National Deaf Mute College, Washington.

The Patent Laws.

We are asked by a Pawnee City, Neb., correspondent if we are not mistaken, when we say that the owner of a patent can collect a royalty of an innocent purchaser. Certainly not; that is one great defect in our patent laws, and one which calls most loudly for a remedy. A farmer goes to the village or city, and among the score or hundreds of stores he sees hundreds or thousands of manufactured articles, and it is utterly impossible for him to know whether they are patented or not, unless they are marked, and it is perfectly unreasonable to expect him to know. Amidst this ocean of implements and tools he sees something that he needs, and innocently purchases it, paying for it all that it is worth, and probably all the patentee would ask for it, if it were purchased of him; but the article being unmarked, he is not informed that it is patented, and if it were marked, the patent mark might be forged. He takes home his purchase, and after awhile the patentee discovers the article in his possession, and compels him to pay a royalty. The principle has been carried out in connection with the drive well swindle. Nobody supposed that there was any patent upon drive wells, but one turned up at last, and the man who had a drive well upon his premises was called upon for a royalty.

There is no shadow of justice in such a law. Nobody has a right to ask of the law immunity from all liability of loss, and in the vast majority of cases the seller of a patented article is sufficiently responsible to save the patentee harmless. As the law now stands, it is dangerous for a farmer to purchase anything unless he knows all about the patent, when it was granted, to whom it was granted, who owns it at the present time, and by what authority the seller presumes to sell it. All this is unreasonable, and every unprejudiced person in all the world must unite in that conclusion. The courts are open for a patentee to obtain an injunction against parties wrongfully selling his patent, and furnish him all the means of protection which the owners of other property have. Let him, therefore, resort to those means, and keep his hands off the farmer, whom the patent man seems to especially select for the purposes of oppression.—*The Western Rural.*

The Laws of Property.

We are asked by an Erehwon correspondent if we are not mistaken when we say that the owner of a horse or a farm can retake his property from an innocent purchaser (the seller having no legal right to sell), or compel the buyer to pay a second time.

Certainly we are not mistaken. That is one great defect of our property laws which thieves and swindlers complain of most loudly.

A city mechanic wants to live in the country, and out of the scores and hundreds of houses and farms and animals there, the history of which he cannot be expected to know, he selects something which he wants, and pays a fair price for it to the man who offers it for sale. When he takes possession the real owner turns up and dispossesses him, or makes him pay a second time. In this way hundreds of innocent mechanics have been swindled in the purchase of farms and horses and cattle and such things.

There is no shadow of justice in such a law. Nobody has a right to ask of the law immunity from all liability to loss, and in the vast majority of cases, the farmer whose property has been sold without his consent should find the seller sufficiently responsible to save himself from loss. It is cruel in him to dispossess the innocent mechanic, who has already paid a fair price for what he has bought.

As the law now stands, it is dangerous for a mechanic to purchase a horse or a house unless he knows all about the owner of it, by what authority the seller offers it for sale, and has a lawyer make a search of the title deeds and all that.

All this is unreasonable, as every unprejudiced land-sharp and horse thief will agree. The courts are open for a farmer to obtain an injunction against parties wrongfully selling his horse or his house or his farm; and he has in that all the protection he can reasonably ask for. Let him therefore resort to those means and keep his hands off the innocent mechanic, whom land-sharps and horse thieves would be glad to prey upon if they found him foolish enough to "go it blind" in his purchases.—*Scientific American.*

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Improved Transportation of Fresh Fruit.

A recent shipment of fresh fruit from California to Philadelphia introduces a very promising improvement in the transportation of such perishable commodities. The car contained grapes, plums, peaches, and apricots packed in carbonized wheat bran; an inexpensive packing, which is claimed to preserve fresh fruit for long periods, making possible their transportation across the continent as "slow freight," at a saving of $600 a car load in freight charges.

Correspondence.

Flat Cast Iron Boiler Heads.

To the Editor of the Scientific American:

In your issue, dated July 2, is an article headed "Boiler Explosion Notes," referring to the explosion at Messrs. Gaffney & Co.'s works, Philadelphia, in which you indicate that "the jury rendered an erroneous verdict, and did not avail themselves of the means at their hands to verify practically the correctness of their conclusions."

The treachery of flat cast iron boiler heads has been practically proven and verified by the numerous explosions they have caused, and the trouble has been that in many cases the true cause of the explosion has not been traced to the flat boiler head, but other reasons given, such as low water, overpressure, etc. After having noticed many such cases in the year 1865, I published in Philadelphia papers and also in my Pocket Book the principal causes of steam boiler explosions, of which one was as follows:

"5th. It is a very bad practice to make boiler heads of cast iron, composed of a flat disk of from two to three inches thick, with a flange of from one to two inches thick, with cast rivet holes. The first shrinkage in the cooling of such a plate causes a great strain, which is increased by riveting the boiler to it. Any sudden change of temperature, therefore, either in starting or putting out the fire, might crack the plate and thus occasion an explosion. Such accident may be avoided by making the cast iron head concave and of even thickness."

The same has been published in my "Treatise on Steam Engineering." These books are well known by the Hartford Boiler Insurance Company, which, moreover, ought to have more experience than I have in the treachery of flat cast iron heads. You say: "The jury had the opportunity of submitting the remaining boilers to a thorough test, and of determining on the spot, in the most convincing manner, whether the inspectors whom they complain of had really been remiss in their duty, and whether the jury's notion that flat cast iron heads are unsafe was really correct."

Such an experiment would have been of no practical use, for the jury would probably have found that the shell of the boiler bursted without injuring the head. The exploded boiler was submitted to hydrostatic pressure by the boiler inspector, who found it strong enough for that purpose, and if he had put on sufficient pressure the shell would probably have bursted first. It is not the pressure alone in the boiler which causes the head to burst, but principally the strain in the iron caused by change of temperature.

It is true, as you say, that "flat cast iron boiler heads are used on hundreds of boilers in all parts of the country, and many years' trial has proved them to be safe and serviceable." A flat cast iron head may be much stronger than a concave wrought iron head, but the mischief is that we have no means of knowing when it is good or bad, for its internal condition cannot be seen from the outside; it may be full of air holes and overstrained by shrinkage, so as to make it burst before it is put into the boiler, of which there have been examples.

The most eminent engineer in Philadelphia defends and approves cast iron heads, and he has a theory to anneal them, as is done with carwheels, which would no doubt remove most of the shrinkage strain, but it would not remove the airholes, nor would it equalize the uneven temperature which the boiler head is subjected to. The strain on a car wheel is of an entirely different nature from that of a boiler head, and if his theory is adopted, there will be more "practical experience" in steam boiler explosions.

In one case, a boiler with flat cast iron heads exploded after the fire had been drawn out and the steam pressure reduced far below its normal working pressure, which explosion killed, if I remember right, six men.

With the above considerations, Mr. Editor, I am convinced that the verdict of the jury was a just one, and the wholesome effect it produced is realized by the fact that the Hartford Boiler Insurance Company has now ordered their boiler inspectors in Philadelphia not to insure boilers with flat cast iron heads over 30 inches in diameter. After the company gets more "practical experience" in boiler explosions with flat cast iron heads I hope they will reduce that diameter to 15 inches. In old times, flat cast iron boiler heads were made of charcoal iron, which is much stronger and less liable to strain by shrinkage than is anthracite iron Charcoal iron also flows more solid in castings and has less air holes than anthracite iron. You say in the article above referred to that "from all the information we can gather it seems pretty certain that the explosion was due to an overpressure of steam," etc.

I assure you, Mr. Editor, that the informations published in the papers about this explosion are in the main unreliable. The safety valves were in good order and did not blow off steam before the explosion, and it was testified in the coroner's inquest that the steam was far below its normal pressure shortly before the explosion. The boiler head evidently burst by shrinkage or expansion strain in the casting.

JOHN W. NYSTROM.

1010 Spruce street, Philadelphia.

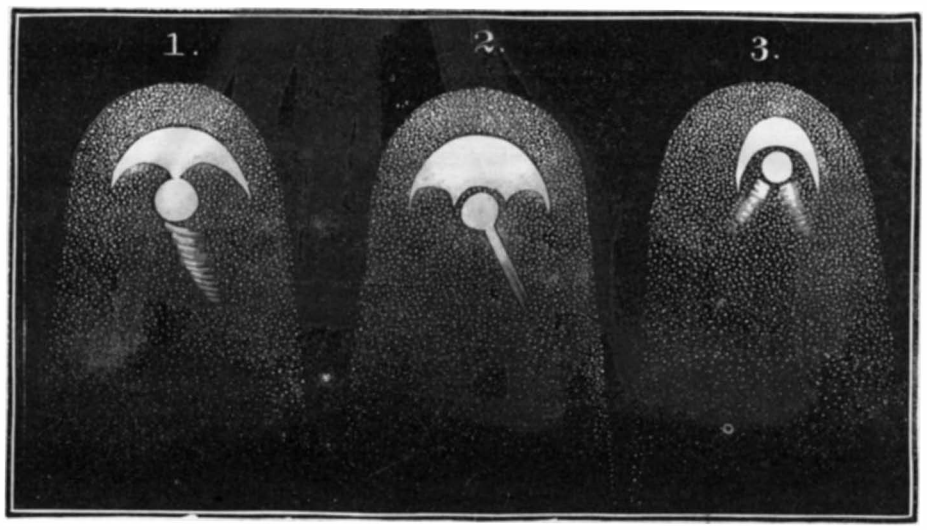
Telescopic Views of the Great Comet of 1881.

To the Editor of the Scientific American:

The accompanying sketches are telescopic views of the comet now adorning our northern heavens. Only the head of the comet is here represented, showing the appearance of the nucleus and coma, and the changes which were observed on the dates mentioned.

Fig. 1. shows the head of the comet as seen on the evening of the 24th ult. The nucleus was round, bright, and of an intense ruddy hue, to the naked eye appearing as bright as Mars. In front of this was a rather slender crescent, less bright, apparently connected to the nucleus, as shown in the sketch.

Fig. 2 shows its appearance on June 26. The nucleus was less bright than on the last observation, with a peculiar flame-like appendage issuing therefrom in a direction opposite from the sun. The crescent had taken the form shown in the engraving.



On July 1 the comet had taken the form shown in Fig. 3. The crescent form was much contracted, was not concentric with the coma as on former occasions, and two faint rays were seen to issue from the nucleus. These changes show great activity, and will doubtless continue, although not in so marked a manner, for same time to come.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., July 11, 1881.

Early Observations of Comet 2, 1881.

To the Editor of the Scientific American:

Who first, in this country, saw the great comet now gracing our northern heavens is a question of interest. From recent observations, in verification of a belief expressed at the time of the comet's announcement, it seems conclusive that very early *telescopic* observations were obtained of the northern end of the comet's tail at my observatory, namely, on the mornings of June 18 and 19 at 2 o'clock.

On the above dates I was sweeping for new comets—as has been my custom upon every favorable night for several years—when at about 2 o'clock I pointed my telescope close down to the horizon for a sweep through the northeastern sky, when, at a point between Capella and Beta Aurigæ, I encountered a misty beam of light. I at first supposed it to be a branch of the Milky Way, but although there were many telescopic stars in the field there was a continuity about the light which attracted my attention. It was brighter on the 19th than the morning previous, which I attributed at the time to a clearer atmosphere, not then suspecting its true character. I am now strongly convinced that it was the northern or upper end of the comet's tail, seen some days before the head had risen far enough to become visible in this country. Its position was about R. A. 5 hours 25 minutes, north declination +5°. The comet's position at announcement, on June 23, would agree very well with this place at the dates mentioned, namely, the 18th and 19th inst.

My verification of this opinion has been delayed by an unfavorable sky—a low bank of misty clouds completely hiding for many days the region of Auriga. But on the morning of July 4, also on the morning of the 7th, the opportunity for which I had been watching came. A clear sky in the vicinity of Capella permitted a careful search, when the beam of light previously seen had *entirely disappeared.*

I have waited for a third observation, but the moon at present interferes. Fortunately the *absence* of this beam of light from the place named can be verified by an examination at any future time; and its absence must, I think, convince every candid mind that a telescopic view was obtained by me of the comet's tail as early as the mornings of June 18 and 19.

Dense misty clouds, which soon gathered in the northeastern morning sky, prevented me from detecting its true nature at that time, and seeing more or less of the entire comet rise.

WILLIAM R. BROOKS.

Red House Observatory,

Phelps, N. Y., July 13, 1881.

The Florida Drainage Scheme.

Mention has already been made of the gigantic scheme for the drainage of the Florida Everglades undertaken by certain Philadelphia capitalists. According to a report by the engineer of the company, the country to be opened to cultivation covers over 17,000 square miles, lying about and to the south of Lake Okeechobee. The land reclaimed will embrace every class of Florida land, including "high and low hammock," "first, second, and third rate pine," and "swamp lands," and under the terms of the contract between the company and the State of Florida one-half of the 8,000,000 acres to be reclaimed by the lowering of the lake waters will revert to the company. Valuable deposits of hematite ore and marl are also reported.

Lake Okeechobee is described as the grand inland reservoir for the waters of middle Florida, having no natural or direct outlet. The principal feeder to it is the Kissimmee River, which pours in a constant supply of 207,360,000 cubic feet of water every twenty-four hours. The amount of evaporation from water surfaces exposed to sun and wind is set down in the books at the rate of from one-eighth to three-eighths of an inch per day, according to conditions. Lake Okeechobee having an area of 1,000 square miles, the evaporation from the surface of the lake aggregates at the lowest rate 290,400,000 cubic feet of water, which is more than one-third in excess of the supply from the main feeder. During the ordinary seasons, and particularly during periods of drought, the level of the water in the lake is lowered, the surrounding land becomes in a measure passable, and large herds of cattle obtain excellent pasturage in the savannas and swamp lands of the interior. Then when the rainy season comes, four months in the year, the waters of the lake gradually rise, overflow the immense tracts of sugar land, the soil of which is identical to that of Cuba, and back up the waters of the rivers emptying into the lake.

It is the purpose of the company just formed to permanently lower the surface of Lake Okeechobee, which, according to the United States survey of 1879, is twenty-five feet above mean low tide, by constructing a drainage canal twenty-one miles in length to the St. Lucie River at a waterfall of one foot a mile. This plan is similar to that recommended by Colonel Meigs to the National Government in 1879. In the proposed canal this waterfall will give a velocity of two and two-thirds miles per hour and a capacity of passing 733,708,800 cubic feet in twenty-four hours.

Three steam dredging machines of the Menge patent, constructed on the continuous ladder principle and resembling the buckets in a grain elevator, are now being put together at Jacksonville, the hulls being already in shape. Each dredge will be capable of making a clean cut of twenty-two feet in width. The dredges will be lashed in pairs, so that at one operation they will open a canal forty-four feet wide. To dig the canal from Lake Okeechobee to the St. Lucie River will require the excavation of 9,000,000 cubic yards, which, at a rate of two cents a yard (the Menge figure), will amount to $180,734, and at an outside figure of five cents a yard will amount to $451,336.

In addition to this canal it is the design to build another canal from Lake Okeechobee to the Caloosahatchie River, emptying into the Gulf; also to deepen and straighten the streams emptying into Lake Okeechobee, to dig lateral canals or ditches, and at various points to tap the ridge separating the saw-grass marshes from the Atlantic and the Gulf, thus draining the remotest sections of that great region.

MISCELLANEOUS INVENTIONS.

Mr. Edwin Thacher, of Pittsburg, Pa., has patented an improved bridge-truss. The object of this invention is to overcome the defects common to a greater or less extent in all forms of triangular or quadrangular truss now in use.

Mr. George Brucker, of New York City, has patented a nickel-plating fluid composed of a saturated solution of pure nickel in nitric acid, and of hyposulphite of soda and cream of tartar.

An improved slide for guard chains which can be adjusted very readily and can be used with chains of any desired thickness, has been patented by Mr. Lewis H. Sondheim, of New York city. It consists in a casing provided with a hinged or removable side and with a longitudinal partition dividing the casing into two compartments provided with springs for pressing the chain passing through the compartments against the opposite side of the casing, by which this casing is held on the chain in the desired position.

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IMPROVED SLOTTING MACHINE.

We give an engraving of a machine for slotting wheels, pinions, etc., for the reception of the keys which secure them in position on their shafts. The solid iron frame supports a circular iron table truly turned, and having several holes for the reception of the vertical threaded studs which confine the yoke that bends the wheel or pinion to the table. A steel saw or cutter projects through a hole in the table and through the bore of the wheel, and is connected at its lower end with a slide moving in ways below the table, and connected by a strong connecting rod with a crank which is driven by a train of gearing from the driving shaft, the latter taking its motion from any suitable source of power through a belt. The gearing increases the leverage of the power over the saw or cutter, so that the motion is very strong and positive, and the work is quickly done. One pair of the gears is made elliptic, which secures a slow movement of the cutter downward while cutting the metal, and a quick return movement upward. The saw is fed up to its work by the lever run at the back of the yoke, and the cut may be made light or heavy according to the character of the work.

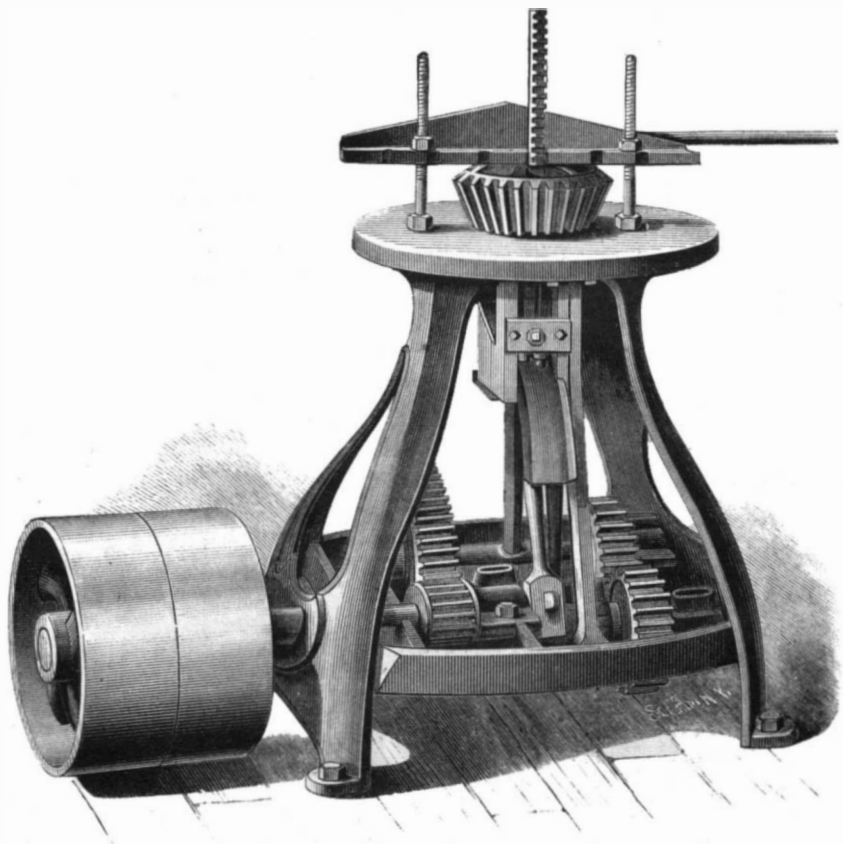
The saw is capable of being ground on an emery wheel, so that it is always possible to have a sharp tool. Different sized saws are made for keys of different widths.

The gearing and slides below are protected by suitable shields which deflect the cuttings so that they fall to the floor. The work is very readily placed in the machine and removed therefrom. The capacity of the machine is much greater than ordinary slotting machines employing a single cutting tool.

The difficulty heretofore with machines of this kind has been that they would leave the key-way higher in the middle than at either end, which necessitated the use of files to true it up.

The machine illustrated avoids this and leaves the key-ways true and ready for the keys without further work. Key-ways of equal depth at each end for feathers, etc., are also readily cut. The rounding up of the bottom of the key-way is avoided by rigidly connecting the cutter to a bar which extends down to the bottom of the machine and there passes through a guide. This guide is pivoted so that the sliding bar may adjust itself to the angle of slope desired for the bottom of the key-way. By this arrangement a movement of the cutter is secured which is parallel to its previous cut, and the defects in the key-ways above mentioned avoided. This machine was patented November 11, 1879.

Further information may be obtained by addressing Messrs. Trevor & Co., manufacturers, Lockport, N. Y.



TREVOR & CO.'S SLOTTING MACHINE.

IMPROVED LUBRICATOR.

Two important results are secured by using upon an engine a lubricator that furnishes a continuous and equable supply of oil to its cylinders. In the first place the engine is properly and sufficiently lubricated, and its durability and efficiency is increased; and in the second place a great saving of oil is effected. The engraving shows a complete and simple device for furnishing a continuous supply of lubricant to engine cylinders, and especially designed for locomotives.

Figs. 1 and 2 are vertical sections of the apparatus taken at right angles to each other, and Fig. 3 is a vertical section of the drop tube.

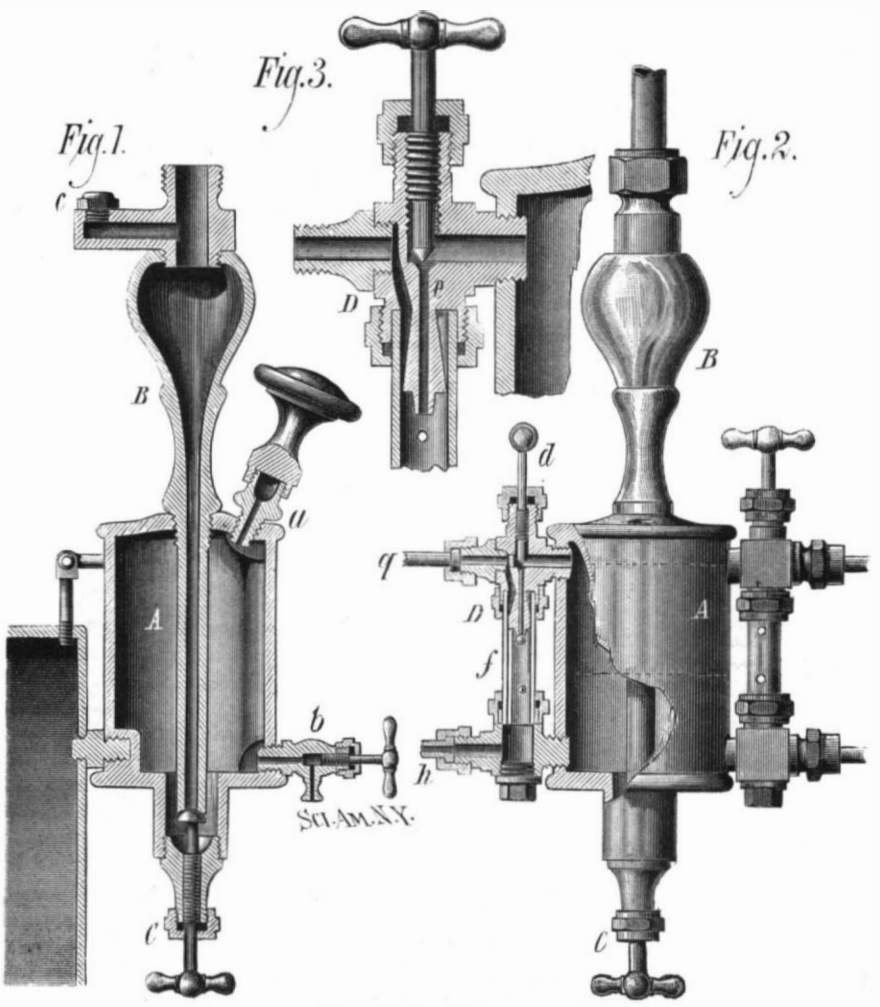
The main chamber, A, of the lubricator is attached to the front plate of the locomotive boiler, and is provided with a pipe, B, that extends downward in the chamber and receives steam from the boiler. The lower end of the pipe, B, is received in a cavity formed at the bottom of the chamber, and is fitted to a valve, C, by which it may be closed more or less to regulate the supply of steam.

In opposite sides of the chamber, A, there are drop tubes, D, communicating with the interior of the chamber near the top, and discharging into a glass tube, *f*, connected with the pipe, *h*, leading to the steam chest of the cylinder. The drop tube is under the control of the valve, *d*, and communicates by a steam pipe, *g*, with the steam room of the boiler. The lower end of the drop tube is reduced in size to insure the falling of the drop in the middle of the glass tube, where it may be observed, and the water of condensation from the steam, entering through the pipe, *g*, is deflected by the conical sides of the drop tube, so that it follows the inner side of the glass tube, and does not interfere with the dropping of the oil. The pipe, *h*, leading to the steam chest has, near the engine cylinder, a double seated ball check valve, which prevents air or steam from being forced back into the oil chamber, A. The apparatus, so far as the drop tubes, side steam, and oil pipes are concerned, is made double to adapt it to the two cylinders of a locomotive, and the oil chamber is divided vertically by a median partition to insure an equal action of the two parts of the device. At the top of the oil chamber there is a plug, *a*, which may be removed whenever it becomes necessary to fill the chamber, and at the bottom there is a small valve, *b*, for letting out the water.

When this lubricator is in use there is an equality of pressure everywhere, and the water resulting from the condensation of the steam from the pipe, B, displaces the oil, which flows over into the drop tubes, D, and falls, drop by drop, through the clear space in the glass tubes, *f*, into the pipe, *h*, which conveys it to the engine cylinder. The flow of oil through the drop tube is controlled by the valve, *d*.

With this device perfect lubrication can be insured without the constant attention of the engineer and fireman. The lubricator is readily applied to the boiler front of the locomotive, in the engine room of vessels and steamboats. For stationary engines, the above lubricator can be placed on the wall of the engine room, and supply with oil the one or more engines and steam pumps. A single lubricator is also made to apply on the steam pipe of stationary engines with one connection. One hundred of these lubricators are now in use, and the manufacturers refer to some of the largest manufacturing works in this country. Some of the railroad companies who have adopted it say they obtain perfect lubrication up and down grade, and effect a saving of 75 per cent in oil, and obtain more power from the engines owing to this system of lubricating, and effect a great saving on the valves and packing.

This invention was recently patented by Mr. Timothy Holland, and is manufactured by Messrs. Holland & Thompson, 217 River street, Troy, N. Y.



HOLLAND'S ENGINE LUBRICATOR.

Glycerin.

Notwithstanding the low price which now prevails for raw produce and manufactured goods, there are a few articles which form notable exceptions. Perhaps one of the most remarkable of these is refined glycerin, which, within the last two years, has advanced from about £30 to £130 per ton avoirdupois for 30° B. This enormous advance is due partly to increased consumption, diminished production, and the influence of speculation working on a market devoid of stocks. In view of the present position of the article and the prospect of a continuance of high prices for a considerable time to come, the attention of soapmakers is now being turned to the utilization of their waste "lyes," and various new processes for recovering the glycerin contained in these liquors have lately been tried with more or less successful results. Apart from minor impurities, waste soap "lyes" are generally found to contain glycerin, carbonate of soda or caustic soda, chloride of sodium, gelatin, and albumen. One of the processes for recovering the glycerin which promises to be the most economical and the most successful, begins with concentrating the liquor until the salts contained therein begin to crystallize. The liquid is then cooled and filtered to rid it of gelatin and albumen. It is afterwards made to absorb carbonic acid, which precipitates bicarbonate of soda, and which is separated from the liquor in the usual way. After undergoing this process the liquor is then made to absorb gaseous hydrochloric acid until what remains of carbonate of soda has been converted into chloride, and further, until all, or almost all, the chloride of sodium has been precipitated and separated from the liquor in the usual manner. Arrived at this stage, the liquor contains water, glycerin, and hydrochloric acid. The acid is then evaporated entirely and absorbed in water for using afresh. The dilute glycerin remaining can be purified by filtering it through animal charcoal or by concentrating and distilling it in the usual way.—*Glasgow Herald.*

Iridescent Copper.

A new invention for coating iron and steel with iridescent copper, says the *Revue Polytech.*, is the work of Dr. Weil, of Paris. First, thirty-five parts of crystallized sulphate, or an equivalent amount of any other salt of copper, are precipitated as hydrated oxide by means of caustic soda or some other suitable alkaline base; this oxide of copper is to be added to a solution of 150 parts of Rochelle salts, and dissolved in 1,000 parts of water; to this 60 parts of best caustic soda, containing about 70 per cent NaO, is to be added, when a clear solution of copper will be formed.

The object to be coppered is to be cleaned with a scratch brush in an alkalino-organic bath, attached as a cathode, immersed in the coppering bath, and treated with the usual precautions, when it will become coated with an adherent film of metallic copper.

As the bath gradually loses its copper, oxide of copper, as above prepared, should be added, to maintain it in a condition of activity, but the quantity of copper introduced should not ordinarily exceed that above prescribed as compared with the quantity of tartaric acid the bath may contain. If the quantity of copper notably exceeds this proportion, certain metallic irisations are produced on the surface of the object. These effects may be employed for ornamental and artistic purposes.

According to the time of the immersion, the strength of the current, and the proportion of copper to the tartaric acid, the iridescences may be produced of different shades and tints, which may be varied or intermingled by shielding certain parts of the object by an impermeable coating of paraffine or varnish, while the iridescent effect is being produced on the parts left exposed.

All colors, from that of brass to bronze, scarlet, blue, and green, may thus be produced at will.

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HOME OF THE AMERICAN OSPREY.

BY DANIEL C. BEARD.

Within half a day's journey of New York city lies an almost desert island, whose barren wildness is interrupted—marred, I had almost said—only by a single habitation. A stone lighthouse perched upon the bluff at the end of the island seems a natural accessory to this lonesome symphony of rock, sand, water, and sky. The inhospitable coast of this island offers no safe port or harbor, but the treacherous sandy beach is ragged and broken with huge bowlders and rocks, against whose flinty sides the angry impetus of the storm wave is dashed and splintered into foam and spray. The occasional fragments of wrecks strewn upon the beach, or forming appropriate monuments to the graves of drowned mariners, testify to the danger of the coast, and add a solemn tone to the sea-song of this desert isle. A marsh or swamp occupies the center of the island, about which grow trees of some height, being in a measure protected from the winds by the surrounding hills or mounds, whose sandy baldness is scarcely covered by a thin growth of wiry grass. At the foot of the hills, stretching to the water's edge, are sandy flats, dotted here and there with trees, gnarled, knotted, misshapen, and dwarfed by exposure to tempest and lack of nourishing soil.

Each summer's vacation, as our yacht has passed this island, my curiosity has been excited by the great number of birds which make it their home. It was partly to satisfy this curiosity, and partly to try the black fishing, which is excellent in the dangerous eddies of the tide, that induced the writer, with two companions, to land upon this island one quiet Sunday morning. As our little sail-boat approached the lighthouse we saw a couple of great northern divers swimming unconcernedly about, or ever and anon disappearing beneath the smooth waters. After landing, we walked over the sandy flats, disturbing by our footsteps scores of night-hawks (*Chordeiles popetue*). These mysterious birds filled the air overhead, and darted down past our ears with a loud whirring noise, while they all kept up a constant repetition of their peculiar cry. Numerous as these birds were we only succeeded in finding one egg. Nests they have none; but so closely does the egg resemble the lichens, dry grass, or moss, that although the mother bird may rise from beneath your feet, it will require a careful search and a sharp eye to detect the little roundish-shaped eggs.

In the low bushes or high grass along the edges of the swamp, we found numerous nests of the swamp blackbird (*Agelaius phœniceus*). Some meadow larks had their nests upon the grass plat in front of the lighthouse door, on top of the bluff. The sandy face of the bluff was perforated with innumerable burrows of the industrious bank swallow (*Cotyle riparia*).

On any part of the island, turn whichever way we would, the large nest of the fish-hawk formed a prominent feature of the landscape, and from sunrise to sunset the American osprey sailed around overhead in graceful curves, protesting with shrill cries against the invasion of their territory by strangers.

Baird says that the American osprey or fish-hawk nests almost invariably in the tops of tall trees. He gives as exceptions to this rule a nest upon a small pine tree in Maine, and one upon a cliff upon the Hudson River. Audubon, I believe, found two fish hawks' nests upon the ground.

With these facts in my mind, I was somewhat surprised to find ospreys' nests scattered around promiscuously upon the sand dunes, piles of driftwood, tops of bowlders and small trees. The nests are all of them rather nicely built, the foundation consisting of quite large sticks, and in some instances pieces of plank weighing fully as much or more than the bird; over this foundation a layer, composed of seaweeds, sponges, and other odd material cast up by the waves, the nest itself being a shallow dish-like hollow, of fine soft seaweeds and grasses. Those I found upon the ground stood about two feet high, but some of them in the trees would measure, from foundation stick to summit, fully five feet. Such nests are eagerly seized upon by the purple grakle or crow blackbird (*Quiscalus purpureus*), and all the interstices between the sticks forming the hawks' nests are often filled with the nests of blackbirds. I counted six blackbirds' nests in the portion of an osprey's nest within sight; there were three eggs in the hawk's nest, and most of the blackbirds' nests contained young birds just out of the egg. Some ospreys' eggs that I took from a nest in a tree were prettily marked with dark purplish or wine-colored markings upon a cream-white ground. I noticed, however, that in four or five different nests upon the ground the eggs were all a dirty-brown color, harmonizing so perfectly with the dry seaweed lining of the nest as to require a quick eye to detect the egg in the nest when the observer stands only a few feet away.

After making some sketches, collecting some eggs, and catching about sixty pounds of blackfish, our party bade farewell to the island, and were rowed out to a passing steamer, which slowed up and took us aboard. A few hours after we were back in the hot dusty streets of the great metropolis, with only our sun-burnt faces to remind us of the island-home of the American osprey.

HOME OF THE AMERICAN OSPREY.

A Sitting Snake.

One of the Indian pythons (*Python molurus*) in the Zoological Society's reptile house, which has been until lately in company with a male of the same species, deposited a quantity of eggs last week, and immediately commenced the duty of incubation, which, as it would now appear, is as carefully performed in these highly-organized reptiles as in the case of the superior class of birds. The "pythoness" is an excellent mother, and has not deserted her post day or night up to the present time. The eggs, which are believed to be about twenty in number, are completely covered by her coils, and the mother herself by her blanket, so that she cannot be seen by the casual spectator. In 1862 a large West African python in the Zoological's Society's collection laid a quantity of eggs, and sat on them nearly ten weeks, after which, as there appeared to be no reasonable prospect of her hatching the eggs, they were removed. But upon subsequent examination several of the eggs were found to have the embryo partly developed. It is hoped, therefore, that a successful result may be obtained on the present occasion.—*London Times.*

Temperature of Least Resistance in Steel.

It is well known that a steel that is very flexible when cold breaks at the blue annealing temperature. It has generally been considered that the purer the iron is the less subject it becomes to this defect, but the workmen of the Ural Mountains, who use irons of remarkable purity, have often observed the same fact. Mr. Adamson has found that the metal becomes powdery at a temperature between 260° and 370° C. (500° and 698° Fah.), or the temperature at which willow twigs take fire.

This phenomenon seems to explain a large number of accidents, as, for example, the breaking of tires under the action of brakes and the fracture of riveted moulds and of machine arbors which become heated by friction.—*Ann. du Gen. Civ.*

THE Holly Manufacturing Company, of Lockport, N. Y., has opened a special office at 157 Broadway, under the charge of Mr. C. G. Hildreth, secretary of the company.

Curious Observations on Ants.

Sir John Lubbock lately read a paper on the subject at a meeting of the Linnæan Society. He said that in one of his former papers (Linnæan Society *Journal*, vol. xiv., p. 278) he had given a series of experiments made on ants with light of different colors, in order if possible to determine whether ants had the power of distinguishing colors. For this purpose he utilized the dread which ants, when in their nest, have of light. Not unnaturally, if a nest is uncovered, they think they are being attacked, and hasten to carry their young away to a darker, and, as they suppose, a safer place. He satisfied himself, by hundreds of experiments, that if he exposed to light the greater part of a nest, but left any part of it covered over, the young would certainly be conveyed to the dark portion. In this manner he satisfied himself that the different rays of the spectrum act on them in a different manner from that in which they affect us; for instance, that ants are specially sensitive to the violet rays. But he was anxious to go beyond this, and to attempt to determine how far their limits of vision agree with ours. We all know that if a ray of white light is passed through a prism, it is broken up into a beautiful band of colors—the spectrum. To our eyes it is bounded by red at the one end and violet at the other, the edge being sharply marked at the red end, but less abruptly at the violet. But a ray of light contains besides the rays visible to our eyes others which are called, though not with absolute correctness, heat rays and chemical rays. These, so far from being bounded by the limits of our vision, extend far beyond it, the heat rays at the red, the chemical rays at the violet end. He wished under these circumstances to determine if possible whether the limit of vision in the case of ants was the same as with us. This interesting problem he endeavored to solve as follows: If an ants' nest be disturbed the ants soon carry their grubs and chrysalises underground again to a place of safety. Sir John, availing himself of this habit, placed some ants with larvæ and pupæ between two plates of glass about one-eighth of an inch apart, a distance which leaves just room enough for the ants to move about freely. He found that if he covered over part of the glass with any opaque substance, the young were always carried into the part thus darkened. He then tried placing over the nest different colored glasses, and found that if he placed side by side a pale yellow glass and one of deep violet, the young were always carried under the former, showing that though the light yellow was much more transparent to our eyes, it was, on the contrary, much less so to the ants. So far he had gone in experiments already recorded; but he now wished, as already mentioned, to go further, and test the effect upon them of the ultra violet rays, which to us are invisible. For this purpose, among other experiments, he used sulphate of quinine and bisulphide of carbon, both of which transmit all the visible rays; and are therefore perfectly colorless and transparent to us, but which completely stop the ultra violet rays. Over a part of one of his nests he placed flat-sided bottles containing the above-mentioned fluids, and over another part a piece of dark violet glass; in every case the larvæ were carried under the transparent liquids, and not under the violet glass. Again, he threw a spectrum into a similar nest, and found that if the ants had to choose between placing their young in the ultra violet rays or in the red, they preferred the latter. He infers, therefore, that the ants perceive the ultra violet rays, which to our eyes are quite invisible.

Now as every ray of homogeneous light which we can perceive at all appears to us as a distinct color, it seems probable that these ultra violet rays must make themselves apparent to the ants as a distinct and separate color (of which we can form no idea), but as unlike the rest as red is from yellow or green from violet. The question also arises whether white light to these insects would differ from our white light in containing this additional color. At any rate, as few of the colors in nature are pure colors, but almost all arise from the combination of rays of different wave lengths, and as in such cases the visible resultant would be composed not only of the rays which we see, but of these and the ultra violet, it would appear that the colors of objects and the general aspect of nature must present to them a very different appearance from what it does to us. Similar experiments which Sir John also made with some of the lower crustacea point to the same conclusion, but the account of these he reserved for a future occasion. He then proceeded to describe some experiments made on the sense of direction possessed by ants, but it would not be easy to make these intelligible without figures. After detailing some further experiments on the power of recognizing friends, he gave some facts which appear to show that ants, by selection of food, can produce either a queen or a worker at will from a given egg. Lastly, he stated that he

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had still some ants which he had commenced to observe in 1874, and which are still living and in perfect health; they now, therefore, must be more than seven years old, being therefore by far the oldest insects on record.

Naval Brass.

In the early part of 1874, in consequence of numerous cases of failure in respect to Muntz metal in ships of the Royal Navy, the attention of the Admiralty was drawn to the subject, and they directed inquiry to be made as to the cause of these failures. Mr. Farquharson, to whom the matter was referred, found that the causes of decay which had been suggested would not account for that which actually took place. In the numerous cases which came under his notice, two conditions of use were always observable, namely, salt water and contact with an electro-negative metal—a fact which pointed strongly to electro-chemical action as the cause of the change. On the other hand there was a total absence of surface-pitting. To the eye the surface of the affected bolts was as smooth and perfect as when they were first made. It was difficult to understand how an internal change, such as actually took place, could come to pass in the way inferred. Fortunately a very simple expedient proved beyond doubt that salt water had penetrated an apparently sound and close metal, and the mystery was thus dispelled. Bolts 3½ inches in diameter, which had been used for securing propeller blades, were shown to have been thus penetrated to the center. In view of these facts, the conclusion that a portion of the zinc had been dissolved out was inevitable, and this explanation has been thoroughly verified by comparing analyses of affected and unaffected parts of the same bolts.

The circumstance that no such change as that to which we now refer was to be found in any of the numerous varieties of gun metal, rendered it probable that it was peculiar to alloys of copper and zinc, so that if a forgeable metal could be produced with tin in its composition, having the requisite strength and ductility, the alloy thus formed would be free from the defect complained of. In the latter part of the year 1874 an alloy, composed of 62 parts of copper, 37 of spelter, and 1 of tin, was proposed by Mr. Farquharson, as possessing the requisite mechanical properties. The Admiralty thereupon referred the question as to the endurance of such metal to Dr. Percy, of the Royal School of Mines, in conjunction with Mr. Farquharson. These parties, after subjecting an alloy of this description to severe tests, under which the Muntz metal completely failed, reported to the Admiralty in 1879 that the new compound had stood the test satisfactorily. Accordingly it was adopted as the service alloy under the title of "naval brass." The process of manufacture is the same as for yellow or Muntz metal. To insure the best results, Australian or English B.S. copper should be used, and the proportions of metal stated above closely adhered to, due allowance being made for the loss of zinc in the process of melting. When finished cold, and left unannealed in rods and sheets of moderate thickness, the metal has a tensile strength of from 67,000 pounds to 72,000 pounds per square inch, according to the amount of rolling it has received. Bolts of any size can be made of it, the usual practice being to take a rod the size of the bolt required, and to form the head by upsetting in a die. This is done without stress or injury to the metal in a bolt or rivet-making machine, with heads two diameters of the bolt.

The new alloy is specified for all ships built for the Admiralty, and the details now given may be of service to contractors and others using naval brass. The metal, not being fusible until above a red heat, gives promise of being valuable as linings to main brasses of engines and for other purposes where white metal is now used, and we understand that arrangments are in progress for testing its value under such conditions. The result will be awaited with interest by many who have experienced the need of a good bearing metal.—*The Engineer.*

Heating Effects due to Compression.

On two former occasions we have taken notice of the results of certain experimental investigations instituted by Professor P. G. Tait, of the University of Edinburgh, in regard to the thermometers used in the Challenger expedition, and the alleged effects of compression upon them when immersed to great depths in the sea. Still pursuing the line of inquiry suggested by the experiments made with these thermometers, the learned professor has since made a further series of experiments on the heating effects of compression of a number of liquids and semi-solid liquids, the results of which he laid before the Royal Society of Edinburgh on the evening of Monday, May 16. He mentioned that he had employed a ton pressure upon each of a number of different substances, and had noticed in each case the rise of temperature due to the compression exerted. Marine glue gave a rise of temperature to the extent of 0·9° Fah.; raw potato, 0·7°; pith, 0·37°; cork, 1·3°; a piece of bar soap, about one-twentieth of a degree; a piece of licorice and a piece of cheese, about three-quarters of a degree; a piece of raw flesh behaved very much like the potato; India-rubber and solid paraffine rose in temperature about 1½°; lithographer's ink and shoemaker's and bees' wax, about 1·4°; lard, about 2°.

After mentioning these details, Professor Tait said it was remarkable that potato and raw flesh, with so large a percentage composition of water, had a large comparative amount of independent heat produced, while pith gave no perceptible difference of effect over what would have been produced by water alone. Cork had this peculiarity, namely, that when the pressure was removed the fall of heat was only 0·9° Fah., as against 1·3° of a rise on the application of the same amount of pressure. That seemed to agree, he said, with what was already known of cork, namely, that on the removal of the pressure it did not spring back to its original form. In these respects India-rubber was opposed to cork, which had this further peculiarity, that, on continued experiment, the amount of heat produced by the pressure gradually fell till it was the same as the amount of cooling which resulted on the relaxation of the pressure. About shoemaker's wax there was the peculiarity that it took a very long time before the heating effect was fully produced. Its chemical composition, also, was of course different from that of beeswax, which yet had precisely the same amount of heat produced. In concluding his interesting communication, Professor Tait intimated that further research would be necessary before they could get definite facts showing the exact heating effects of compression, which, he added, would form the subject of a future communication.—*Engineering.*

The Curse of Poor Printing.

Short-sightedness, or myopy, is increasing to an alarming extent among civilized nations. It is commonly supposed that only a few persons are thus afflicted, but the truth is that a large portion of every community is more or less troubled with imperfect vision. Myopy among school children and attendants at higher institutions of learning in this and other countries has been thoroughly investigated by Prof. Hermann Cohn and a number of other eminent oculists, who have examined in all more than forty thousand scholars. The facts they have gathered deserve the most serious consideration.

The general conclusions arrived at by all the investigators have been formulated by Prof. Cohn, as follows: "1. Short-sightedness hardly exists in the village schools—the number of cases increases steadily with the increasing demands which the schools make upon the eyes and reaches the highest point in the gymnasia. 2. The number of short-sighted scholars rises regularly from the lowest to the highest classes in all institutions. 3. The average degree of myopy increases from class to class—that is, the short-sighted become more so." It was found that in the village schools scarcely one per cent, in the elementary schools five to eleven per cent, in the girls' schools ten to twenty-four per cent, in the real schools twenty to forty per cent, and in the gymnasia between thirty and fifty-five per cent of the pupils are myopic. In the prima of several German gymnasia more than sixty per cent of the students are myopic, at Erlanger eighty per cent, and at Heidelberg not less than one hundred per cent. Examination of university students has so far been made only at Breslau and Tübingen, where, in 1867, Prof. Cohn found that fifty-three per cent among the Catholic theologues were short-sighted, fifty-four per cent of the law students, fifty-six per cent of the medical students, sixty-seven per cent of the evangelical theologues, and sixty-eight per cent of the students of philosophy. Some nationalities are much more troubled by the affection than others. For instance, in New York twenty-seven per cent, and in Boston twenty-eight per cent of the pupils in the gymnasia were found to be myopic, while at Tiflis thirty per cent of the Russians, thirty-eight per cent of the Armenians, and forty-five per cent of the Georgians were near-sighted.

Prof. Cohn cites among the principal causes of myopy, badly constructed school benches, bad writing, and bad type. The latter evil he says deserves especial attention, and for remedying it he makes some valuable suggestions, of which the following are the most important:

"The most important point is the size of the letters. We cannot determine this by the measurement of the em, as the printers do, for that regards the shank of the type, of which readers know nothing; but it must be judged by a special measurement of the visible letter. I have adopted as the standard of measurement the letter n, that being the most regular and symmetrical in shape in both the Roman and German alphabets. I have found that the n in pearl type is about three one-hundredths of an inch high, in nonpareil about one twenty-fifth of an inch, in brevier about one-twentieth of an inch, in long primer one-seventeenth inch, and in pica one-fourteenth inch. We have hitherto had no definite rule concerning the smallest size of letters which should be permitted for the sake of the eyes. The distance at which a letter of any particular size can be seen does not afford a guide to it, for it does not correspond at all with the distance at which matter printed in the same type can be read steadily at the usual distance in reading. I believe that letters which are less than a millimeter and a half (one-seventeenth inch) high will finally prove injurious to the eye. How little attention has hitherto been paid to this important subject is exemplified in the fact that even oculistic journals and books frequently contain nonpareil, or letters only a millimeter (one twenty-fifth inch) high. Many of the text books required by the school authorities are badly printed. The officers should go through every school book with a millimeter rule in their hands, and throw out all in which the letters are less than a millimeter and a half high, and should give the preference to those establishments which do not use letters of less than two millimeters (one-thirteenth inch). The distance between the lines is an important factor in respect to ease in reading. As is well known, the compositors often insert thin leads between the lines so that the letters which project above the average height and those that fall below the line shall not touch. Every one knows that legibility is improved by contrast; the darker the print and the clearer the paper, so much easier is the reading. When the lines are close together, or the matter is printed 'solid,' the eyes become tired sooner, because the contrast is lessened. The lines tend to run together, and the effort to separate them strains the eyes. In fine editions the lines are widely separated. I consider a book well leaded in which the interlinear space, measured by the shorter letters, amounts to three millimeters (one-eighth inch). The lines will really seem to be closer, for the projections of the longer letters will encroach upon the interlinear space; and cases may occur, where those letters predominate, in which the space may seem to be only one millimeter. The narrowest interval that should be permitted is, in my opinion, two and a half millimeters (one-tenth inch)."

In view of the formidable statistics we have given in regard to the prevalence of short-sightedness, it is evident, says the *Paper World*, that everything which will tend to lessen the evil should be undertaken without delay. Neglect in this matter will result in everybody's wearing glasses, and in seriously impeding the performance of all the world's work, especially those branches that particularly require the exercise of good eyesight. In the matter of printing, especially, reform is called for. There is no reason why small type, or type arranged in lines having inadequate space between them, should be tolerated, and the public should stoutly refuse to countenance the use of any school books or patronize papers and periodicals that are printed without regard to the best interests of the students' or readers' eyes.

[It is pleasing to know that the size of type and general style of printing still used, and first adopted by the SCIENTIFIC AMERICAN thirty years ago, are now recommended, by eminent authorities, to be the best standard for eye health. Our paper has always been regarded by printers and readers as a model for typographical excellence; hundreds of periodicals, at home and abroad, have followed it as a pattern. But the particular reasons why typography like that of the SCIENTIFIC AMERICAN has proved so satisfactory and popular, have perhaps never before been so clearly explained with measurements as by Prof. Cohn in his statement above given.]

The Examination of Food and Drugs.

The "Act to Prevent the Adulteration of Food and Drugs," lately passed by the New York Legislature, has been approved by the Governor. It provides that the State Board of Health shall take cognizance of the interests of the public health as it relates to the sale of food and drugs and their adulteration, and make all necessary investigations and inquiries relating thereto; and penalties are provided for any offenses calculated to impair the strength, quality, or purity of substances used as food or medicine.

The sanitary committee of the State Board met in this city July 6, and appointed, under the act, Drs. C. E. Munsell and A. L. Colby, of New York city, and Dr. T. Delap Smith, of Fulton county, as inspectors, to collect food for analysis. The examination of samples will be made by the following named chemists:

Dr. S. A. Lattimore, of the University of Rochester, to examine canned food and spices. Dr. Pitt, of Buffalo, to examine sugar, glucose, sirups, molasses, confectionery, honey, soda water sirups, and ice cream. Dr. Cauldwell, of Ithaca, to examine butter, cheese, lard, and olive oils. Dr. Englehart, of Syracuse, to examine wine, beer, spirits, and cordials. Drs. Lattimore and Hoffman, to examine tea, coffee, and cocoa. Dr. Cauldwell, to examine chemicals as met in pharmacy, quinine and its preparations, ether, and fruit essences. Dr. Chester, of Hamilton, to examine meat extracts, fish and fish extracts, and gelatine. Dr. Hoffman, to examine vegetable and animal drugs and all pharmaceutical preparations. Dr. Love, of New York city, to examine cereals, grain products, artificial cereals for the use of invalids and children, baking powders, and all chemicals used in baking. Dr. Chandler, to examine milk and its preparations.

Nitrates in Nevada.

An extremely important addition has lately been made to the list of valuable minerals found in Nevada. It consists in the discovery of large beds of nitrates near Brown's Station, Humboldt Desert. The State Mineralogist of California, Mr. H. G. Hanks, finds the mineral to be a very rich nitrate of soda, and regards the discovery as one of the most important ever made on the Pacific Coast. Mr. Hanks expresses the opinion that other similar deposits will be found, as large regions of Nevada and California are of a formation suitable for its existence. Many years ago he predicted the discovery of nitrates in the southern part of California, but as yet none has been found. The Nevada discovery will doubtless turn the attention of prospectors to this valuable mineral.

Hydraulic Mining in California.

The question of mining *débris* and the preservation of river bottoms endangered by the "slickens" and "tailings," deposits from hydraulic and other mines, has been brought before the courts in an action begun by the State Attorney-General against the Miocene Mining Company, praying that the Mining Company be restrained from discharging into the Feather River any dumpings or tailings. The desired injunction has been granted by Judge Denison, Superior Court, Sacramento county, Cal.

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QUARTZ AND MARL AS WOOD FILLERS.

A very interesting law suit was decided not long ago by Judge Shipman, U. S. Circuit Court, Connecticut, in which the various processes of finishing and varnishing fine woods, and the values of fillers for that purpose, were elucidated. The suit was for infringement, brought by the Bridgeport Wood Finishing Company, owners of Wheeler's quartz filler patent of January 18, 1876, against Hooper. The latter denied the infringement, and showed to the court that he was working under a patent similar to Wheeler's, for a filler issued in 1856, or twenty years prior to the date of the Wheeler patent. It both cases it appeared that the basis of the filler is the same, namely, oxide of silicon or quartz. This curious question, therefore, appears to have presented itself: How can the use of a patent granted for an oxide of silicon filler, granted in 1856, infringe a patent for an oxide of silicon filler not granted until 1876? This is answered and much valuable information given in the following extracts from the decision of the court:

In the cabinetmaker's art, says Judge Shipman, it is neces sary that the grain or the pores of the wood upon the surface should be filled with some material in order that the surface may be smooth, resist moisture, and receive a permanent polish. Divers materials and combinations of materials, such as beeswax, copal, starch, pumice-stone, plaster of paris, and various gums have been used, but all proved ineffectual. They absorbed the varnish which was used for polishing, shrank, rolled out, or discolored the wood.

What was needed was a non-absorbent transparent article which would fill the pores and make a permanent, hard, smooth surface. The process of finishing cabinet work without the use of a filler involved a large expenditure of money and of time. It is described by the patentee as follows:

"I found [in the Wheeler & Wilson Company's finishing department] the system or process of finishing to be, first, as the work came from the cabinetmaker, to give it a heavy coat of oil, to let that dry a week or more, then sandpaper the work with boiled linseed oil until the gum of the oil, the fiber of the wood, and the sand that came off the sandpaper produced a sort of gummy paste, which, in the process of rubbing, would lodge in the open pores of the wood, and which required much time and hard rubbing to fill the grains passably. This gum, being composed of oil, required much time to dry; otherwise, if varnished before it was dry it would shrink in drying and crack and displace the varnish. This was the process for finishing all the ordinary work. The finer quality of work, known as 'hand-polish finish,' required to be varnished with from three to five coats of what is known as 'scraping varnish,' which, when dry, was scraped off with a cabinetmaker's steel scraper, leaving none of the many coats of varnish on the work except that in the grains of the wood below the surface, after which from three to five coats of polishing varnish were applied. Then the work was rubbed down with pumice-stone and water and polished up with rotten-stone and the hand, the palm of the hand bringing the polish up. This process is the same as heretofore used by all piano makers in the country."

The invention and the difficulties which it was intended to obviate are thus described in the specification:

"Heretofore various materials have been used to fill the grain in processes of finishing woods, such as pulverized marl, clay, flour, chalk, starch, and different gums, but all are found to have objectionable features in use, which my new process is designed to obviate. In some of the substances employed the particles when powdered are round or spherical and without angles, and consequently do not readily adhere to each other and unite with the pores of the wood, and others are wanting in durability and subject to injurious atmospheric action.

"I am also aware that various forms of infusorial silicates have been used in mixtures for filling the grain of wood, but these are all very powerful absorbents of liquids and carry the moisture by the quality of their capillarity into the wood itself, which has to be removed by evaporation before the varnish can be applied to the surface of the wood, and which opens the pores when said moisture is evaporated and prevents it from being solidified or producing a hard or smooth surface ready for the varnish.

"I use finely powdered flint, quartz, or feldspar, which are non-absorbents of moisture or liquid of any kind, and which fill the pores of the wood by the particles packing together similar to a concrete, and which are combined with any fluid substance that will permit their being rubbed into the surface, such as oil or varnish or other similar fluids. The finely powdered flint or quartz being so mixed to about the consistency of jelly, and colored, if desired, to match the wood to be filled and polished, I apply the mixture with a pad of cloth or leather to the wood and rub it into the pores until they are full, when, by a little continuous rubbing, the surplus material will adhere to the pad or cloth until the whole surface of the wood is cleaned off, leaving the pores of the wood entirely packed, and when dry presenting a smooth, hard, and glassy surface of great durability, upon which one coat of varnish will produce all the finish desired for fine furniture."

The claim is—

"In the art of filling wood, the employment of finely powdered flint, quartz, or feldspar, mixed with oil or other fluent substance, substantially as described."

The invention has proved to be a great success, the filler has gone into extensive use, and has effected a very large saving of time and expense in the manufacture of furniture, and is used upon the finest work. It makes a hard, permanent, and glassy or transparent surface, impenetrable to oil or moisture, leaves the wood in its natural color, and requiring the application of but a single coat of varnish. The reasons of its superiority consist in its non-absorbent quality and mainly "in the peculiar nature of the ground quartz. The particles, being angular, sharp, and, I might say, needle-pointed, they readily enter into and unite with the fiber of the wood, and when once united with the fiber of the wood it is impossible to displace them; and when large orifices require to be filled the particles readily pack one upon another and become permanent and solid." The jelly-like mixture of oil and varnish with the quartz forms, when rubbed into the pores of the wood, "a hard, impenetrable substance, which in itself forms a protection to the wood."

The defendants made and sold, prior to the date of the bill and after the assignment of the patent, wood-filler which is substantially the plaintiff's article, and, like the plaintiff's, made from powdered quartz. It is not denied that the manufacture and sale of this material is an infringement of the plaintiff's patent.

The principal defense is that the defendants had the right to use the material under a license from James Perry, to whom was granted a patent, dated September 11, 1856, which, it is claimed, includes the Wheeler patent. The claims of the Perry patent are:

1. The use of silicious marl or infusorial earth for the purpose of filling and polishing wood, substantially as herein set forth.

2. The combination of silicious marl with any or all of the substances herein named—sulphate of zinc, muriate of ammonia, gum-arabic, gum-tragacanth, and oil—substantially in the manner and for the purpose herein set forth.

The theory of the defendants is this: Flint and quartz are chemically silica more or less pure, or what is known to chemists as "silicic acid." Feldspar is a silicate of alumina and potash, and contains silica in large quantities. Quartz and flint contain from eighty-five to one hundred per cent of pure silica. Infusorial earth is a fine grained earth formed by the deposition of the silicious coatings or shells of microscopic plants, called "infusoria," on the bottom of ponds or lakes of water, and is mostly silica mixed with carbonate of lime and other impurities. Silicious marl is a mixture of clay and carbonate of lime and silica in the form of sand or infusorial shells. Silicious marl contains from twenty to fifty per cent of silica. As, therefore, quartz or flint contains from eighty-five to one hundred per cent of silica, and infusorial earth and feldspar are mostly silica, and silicious marl contains fifty per cent of the same chemical substance, a grant of the exclusive right to use infusorial earth or silicious marl gave also the right to use quartz, flint, or feldspar, the five articles being substantially silica.

The sufficient answer to this theory is that, acknowledging the facts which have been stated to be true, and that these articles are chemically very similar, yet practically for use in the arts the respective classes of articles which are named in the two patents possess very different properties. Infusorial earth is a vegetable tissue, "porous and delicate in structure," friable, and of chalky texture, and not possessing the hardness and sharp angles and needle-like points of powdered quartz, flint, and feldspar, qualities which cause the quartz, flint, or feldspar to find a permanent lodgment in the pores of the wood and thoroughly fill them, so that a new, hard, unabsorbent surface is formed.

As charcoal and the diamond are alike chemically composed of carbon, yet are very different substances in the arts, and are used for different purposes, so quartz and infusorial earth, though chemically similar or substantially identical, are dissimilar in the uses to which they are adapted. Infusorial earth, though chemically silica, is unfitted for the purposes of filling wood, for the reasons which render chalk or starch unfitted, while powdered quartz has been found to possess qualities which make the plaintiff's article the only efficient and useful filler known to the cabinet manufacturers of the country.

Silicious marl is as ill adapted as infusorial earth, because, while marl contains more sand than is found in infusorial earth, yet the sand is in rounded and not angular grains. Feldspar breaks, like quartz, into angular fragments, and is also non-absorbent.

The chemical character of the articles named in the two patents and the differences for practical use between the two classes of articles are tersely and clearly stated in the following extract from the testimony of Professor Samuel W. Johnson, one of the experts called by the plaintiff. Professor Johnson testified:

"Quartz, chemically, is oxide of silicon. It contains no hydrogen and yields no water when heated. Its specific gravity is 2·65. It will not readily dissolve in a boiling aqueous solution of potash or soda, even when finely pulverized. This specimen of infusorial earth, Exhibit 'M,' which consists very largely of the skeletons of microscopic plants, is chemically oxide of silicon plus water, and when heated gives off several per cent of water. Its specific gravity is less than that of quartz. It is softer than quartz. It dissolves with the greatest ease, to a large extent, in a boiling aqueous solution of potash or soda. It is, therefore, chemically distinct from quartz, and is classed by mineralogists with the opal, as a mineral species distinct from quartz.

"Again, the quartz powdered as specified in the Wheeler patent is seen under the microscope to consist of sharp, angular particles, which, when applied to the surface of wood by rubbing with a cloth or leather pad, are forced into the pores of the wood, where they firmly lodge and effectually fill these pores with an impervious material. The hardness of quartz is such that in the process of filling its particles are not further pulverized to any appreciable extent, but are simply forced into the wood, from which they can not be easily dislodged. Infusorial earth, on the other hand, is friable under pressure and friction, and has a chalky rather than a gritty texture. It presents no angular fragments which can be rubbed into the pores of the wood so as to fill them with an unabsorbent material. Quartz is a crystallized silica of a mineral origin, and, in common with all crystals of such origin, has no porosity that can be detected by the highest magnifier, and is in mass absolutely impenetrable to water, oil, or other similar liquids. Infusorial earth, on the contrary, is a hydrated silica that has been organized into the structure of a plant, and, in common with all vegetable tissues or organized structures, is porous and delicate in structure, so that in respect to texture, hardness, sharpness, it is quite the opposite of powdered quartz in its application as a wood filler."

The sand or silica found in silicious marl is chemically identical with pulverized quartz, "inasmuch as both consist of oxide of silicon or quartz, but, physically and practically, for the purposes of wood filling, different, because the sand, mixed with infusorial earth, being a geological sediment, consists of rounded water-worn grains, while powdered quartz of the Wheeler patent consists of angular, sharp-edged fragments and splinters."

The Wheeler patent was accordingly sustained.

MECHANICAL INVENTIONS.

Messrs. Francis Seymour and Augustus Bannigan, of Paterson, N. J., have patented an automatic stop-motion for spinning-machines, whereby the operation of the machine is arrested if a thread breaks. It is more particularly an improvement in the class of silk doubling and spinning machinery in which a faller-wire is hung by its eyelet end to the thread, and with the breakage of the latter falls upon the arm of a balance-lever and actuates a detent. In this invention the action of the spinning and doubling devices is arrested when a thread breaks by the depression of a spring-lever, which operates by gravity upon other devices so arranged as to raise or depress the bands of the several spindles, and thus shift them from fast to loose whirls or pulleys. Simultaneously with this operation and result the doubled thread is removed from between the drawing rolls by the action of the doubling device, which is suitably connected with the band shifters.

Intermittent Luminous Signals.

In the ordinary use of lamps for lighthouse signals the intermittences are produced by a diaphragm which moves before the light, so that the fuel is wasted during the eclipses. At present the average waste of light is about 65 per cent, but if a signal was sent twice a minute, sufficient to indicate the first two letters of the lighthouse, there would be a waste of about 90 per cent. In order to remedy this extravagance Mercadier proposes to adopt a Dubosq lamp with a round wick and a tube in the center of very small diameter, through which a jet of oxygen can be discharged upon the top of the wick. In spite of the high temperature of combustion, the lamp does not heat much; it consumes little petroleum, and the wick does not crust. Therefore it will operate for many days without being trimmed or filled anew. The intense flame is produced by the combustion of petroleum vapor at the center of the jet, and the surrounding film of air being a bad conductor the lamp heats only at the top of the burner. The oxygen is inclosed in a reservoir, under suitable pressure, which in his apparatus does not exceed 4 millimeters (0·157 inch) of mercury; it first passes through a manipulator, which has a form similar to that of the key of a Morse instrument, traversing a caoutchouc tube, which is pressed together when the key is at rest. Upon depressing the key the pressure upon the tube ceases, and the oxygen reaches the flame; when the key is released the oxygen jet is stopped. In this manner the flow of oxygen is manipulated as simply as the electric current in the Morse system. The rapidity of manipulation is more than sufficient for all the requirements of optical telegraphy. A method somewhat similar has been contrived by Mercadier for the electric light.—*Compt. Rend.*

Decomposition of Light by a Wheel.

It occurred to me that light might be decomposed by interrupting, with a reflecting surface, a ray of light in such a manner that the interruptions may be proportional to the wave length period of any particular ray forming a part of a composite ray. The experiment is effected in the following way:

A wheel, having bright spokes (the large wheel of a bicycle answers well) is caused to revolve between an observer and the sun, so that a ray of light is reflected to the observer by a bright spoke; then, when 120 spokes pass before the observer per second, violet light shines out vividly; when 65 pass red appears, and different rates of revolution give different colors. There seems to be a marked relationship existing between the number of spokes which pass by and the wave-length of the two colors mentioned, that of the violet being one sixty-thousandth of an inch, and that of the red one thirty-four-thousandth of an inch.

I am now investigating this apparent relationship between spoke interruption and wave length for the other colors of the spectrum of white light, and I hope to be able to make known the results shortly.—*Frederick J. Smith, in Nature.*

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Wanted—Good Boiler Floats. Box 498, Bellevue, Ohio

Acker, Merrall & Condit sell Van Beil's "Rye and Rock" to the trade and at retail.

The Common Sense Dry Kiln prevents check, warp, or hardened surface. See St. Albans M'f'g Co.'s adv. p. 60.

Wanted.—Responsible parties to make and sell on royalty an improved Sash holder. J. Lynch, 52 Suffolk St., Lowell, Mass.

Luminous Paint or Varnish for Clocks, Watches, Signs, etc. Sent by mail for $1 a package. James Pool, Mt. Carmel, Ill.

Your boiler is predisposed to weakness by thickening of the water or burning of the iron caused by impurities in feed water. They should be removed by Hotchkiss' Mechan. Boiler Cleaner. 84 John St., N.Y. Circulars free.

Moulding Machine.—For Sale, No. 1 12-inch 4-roll 4-side S. A. Wood's Inside Moulder, in good condition. Belcher & Bagnall, 40 Cortland St., N. Y.

For Sale.—Turret Lathe, with Chaser Bar. No. 1 and 4 Root Blowers. B. & W., 261 N. 3d St., Phila., Pa.

Patent for Hoisting Apparatus illustrated on page 38, current volume of SCIENTIFIC AMERICAN, is for sale. Address Geo. Speidel, 933 Buttonwood St., Reading, Pa.

J.J.Callow's new graini'g and letteri'g catal'g, Clevel'd, O.

Tarred Roof'g, Sheath'g Felts. Wiskeman. Paterson, N.J.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

List 26.—Description of 2,500 new and second-hand Machines, now ready for distribution. Send stamp for the same. S. C. Forsaith & Co., Manchester, N. H.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

For Machinists' Tools, see Whitcomb's adv., p. 12.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Clark Rubber Wheels adv. See page 28.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 29.

Safety Boilers. See Harrison Boiler Works adv., p. 29.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 29.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 28.

For Sequeira Water Meter, see adv. on page 30.

Cope & Maxwell M'f'g Co.'s Pump adv., page 45.

The Sweetland Chuck. See illus. adv., p. 46.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 46.

See Bentel, Margedant & Co.'s adv., page 61.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Telegraph, Telephone, Elec. Light Supplies. See p. 62.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 62.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 62.

The Medart Pat. Wrought Rim Pulley. See adv., p. 61.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 61.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 28.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 62.

For best Duplex Injector, see Jenks' adv., p. 60.

Renshaw's Ratchet for Square and Taper Shank Drills. The Pratt & Whitney Co., Hartford, Conn.

Walrus Leather, Walrus Wheels, Pure Turkey Emery Star Glue for Polishers. Greene, Tweed & Co., N. Y.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 61. Totten & Co., Pittsburg.

Improved Skinner Portable Engines. Erie, Pa.

4 to 40 H. P. Steam Engines. See adv. p. 61.

Green River Drilling Machines. See ad. p. 45.

Blake's Patent Belt Studs. The strongest fastening for leather and rubber belts. Greene, Tweed & Co., N.Y.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. H. writes: 1. I want to make a cylinder of sheet platinum. Can you tell me how I can make the necessary joints so that they will stand intense heat? A. Platinum can be welded upon itself at a high temperature. The metal can be heated hot enough in a good forge fire. It should be embedded in quicklime to protect it from the carbon. 2. Is Professor Dolbear's telephone patented? Your article last week did not state so. A. Yes.

(2) W. H. C. says, in answer to B. W. B., page 409 (4), vol. xliv.: "According to Hager, the 'Encre pour les Dames' (ink for ladies), characters written with which fade out in about four weeks, consists of an aqueous solution of iodide of starch."

(3) E. S. asks for a receipt for making a first class shoe blacking. A. See page 218 (15), vol. xliv. 2. How can I dye glass a blue or red shade? A. Colors are usually imparted to glass in the melting pot: for blue, oxide of cobalt is used; for red, sub-oxide of copper or gold. Glass is stained by painting its surface with a fusible colored glass ground to a fine powder and mixed up with gum water or turpentine, and after drying then heating the painted glass in a furnace until the coating fuses. Collodion, shellac, or spirit copal varnishes, properly colored with one of the coal tar dyes, can in some cases be advantageously employed as a colored wash for white glass.

(4) J. G. P. asks how to dye blonde hair to a light brown. A. The expressed juice of green walnut shells diluted with water is used for this purpose.

(5) C. F. P. asks: How can elastic rubber be melted so as to be run into moulds? A. Rubber cannot be melted as you propose. It decomposes at a temperature high enough to melt it. Pure, unvulcanized gum rubber (caoutchouc) can, however, be softened by a gentle heat (or by hot water) so as to admit of moulding with pressure.

(6) J. E. asks: Is there any process known for hardening oils, say, for instance, tar oils, to thickness of paste, without boiling or soap? A. We know of no way of thickening tar oil or similar oils except by adding to them a sufficient quantity palm oil, lard, or other solid or semisolid substance.

(7) E. H. writes: Please state the difference in your paper of benzine, benzole, naphtha, and methyl alcohol. A. Naphtha and benzine are light products of the distillation of petroleum; the former has the lowest specific gravity. Benzole proper, is one of the distillates of gas tar. Methyl alcohol, or wood naphtha, is an alcohol obtained as one of the products of the destructive distillation of wood.

(8) T. K. writes: I am doing some work in a building where there is a radiator 75 feet long, 10 pipes high, made of 1 inch pipe with a header on each end; it is provided with air valves, and has one-eighth of an inch descent to the foot, and yet it is constantly air bound. It is supplied with steam through a 1¼ inch pipe and drained by a 1 inch pipe. If I cut this radiator and make two radiators of it will it remedy this trouble? A. We think cutting and giving the pipes more descent would be effective. 2. Can steam pipes have too much descent? A. No, provided they be kept clear of water.

(9) P. R. writes: 1. I have made a Holtz electrical machine from directions in SCIENTIFIC AMERICAN, No. 16, and SCIENTIFIC AMERICAN SUPPLEMENT, No. 278. I followed directions, and the mechanical part is well done, but I am unable to charge it or to get any trace of electricity. If I have made any mistake it must be about the paper inductors, as I had at first inductors only on the posterior face of the stationary disk and gilt paper on outside of inductors; but I altered in accordance to your answer to G. W. G., query 29, in SCIENTIFIC AMERICAN, June 18, with no better result. A. With the most perfect of Holtz machines it is impossible to generate a current in the warm sultry days of summer unless the plates are warmed and kept dry. It is probable that your machine would work well any time after August and before May. If you try it every day through the summer you will discover that it will work on some days quite well and at other times not at all. 2. If the ends of the two paper inductors are flush with the edge of the hole or window, and the two projecting serrated ends of the gilt paper to reach the center of the window, are these two serrated ends to be left apart or pasted together? A. They are pasted together. 3. Please explain the action of the cross arm, G. A. The cross arm equalizes the charge on the revolving plate and prevents carrying the negative charge to the positive inductors, and prevents the positive charge from being carried to the negative inductors.

(10) W. M. asks: Which will stand exposure to the weather, the best zinc or best quality of marble? A. Zinc (if pure), under ordinary circumstances.

(11) F. A. H. asks: 1. In estimating the evaporative capacity of steam boilers, is the surface of the furnace sheets considered more effective than the surface of the flues? If so, what is the accepted ratio? A. Yes, four to six times more effective. 2. In estimating the surface of the flues or tubes, is the internal or external surface to be considered as heating surface? A. External, or water surface. 3. What proportion of the flue or tube surface is considered effective? A. From 25 to 40 feet heating surface to one of grate, depending upon diameter of flues or tubes and length. 4. What is the usual allowance of effective heating surface per horse power? A. From 10 square feet in plain cylinder boilers, 12 square feet in flue boilers, and 15 to 17 feet in tubulars. 5. What are some good reliable books on the subject of boilers? A. "Barr on Steam Boilers" would suit you.

(12) G. A. G. writes: 1. I have SUPPLEMENT, No. 252, on telescopes. Will the terrestrial eyepiece, Fig. 7, used with an achromatic object lens, answer for astronomical purposes, as well as the meniscus lens and the eyepiece described and figured on pp. 4015? A. The terrestrial eyepiece is not so powerful as the astronomical eyepiece, but it may be used for astronomical observations. The achromatic objective is to be preferred for all purposes. 2. Please give the dimensions of focal lenses for astronomical eyepiece. A. This information is given in full in the article referred to.

(13) H. W. B. asks: 1 How many cells of gravity battery I need to run the simple electric light mentioned in SCIENTIFIC AMERICAN, vol. xli., No. 18, November 1, 1879, page 274? A. The gravity battery is not adapted to electric light. Use 12 to 18 cells of Bunsen's battery. 2. Also please give simplest mode of making carbon plates or pencils from gas retort carbon. A. Select bright clean coke and pulverize it finely. Mix with it a small proportion of finely ground bituminous coal and ram into a mould. Put the mould into an iron box, and surround it with coke dust. Seal the box with clay, and heat to a red heat in a muffle for several hours. When cool soak in thin treacle and bake as before.

(14) A. B. F. asks: 1. Who or what nation or race of people adopted the present mode or style of making figures as is in use generally? The Romans, I suppose, were the originators of the letters for figures. A. Ancient Indians (of Hindostan). 2. Who was the originator of the higher branches of mathematics (algebra, etc.)? A. The originators of the figures. The systems were improved by Descartes, Newton, Leibnitz, Laplace, Euler, and others. 3. How many comets are visible at this time? A. One. 4. Will you please give a good receipt to make sherbet. A. Sherbet is simply lemonade.

(15) E. P. writes: 1. I am building an engine the cylinder of which is 3½ inches by 5 inches. What horse power will it be? How do you find the horse power of an engine? A. See SUPPLEMENT, No. 253, for this information. 2. What size boiler will the engine need? A. A boiler with about 100 square feet heating surface, say, vertical tubular, 32 inches diameter by 46 inches high. 3. What size boat will it drive? A. 26 to 28 feet length by 5½ feet beam. 4. What will be the size and weight of the screw or propeller needed? A. 26 inches to 30 inches diameter by 33 inches to 36 inches pitch. 5. At what speed will it drive a boat of proper dimensions per hour? A. Probably seven miles.

(16) O. R. M. wants a good process of making vinegar quickly. A. What is known as the German process is the most rapid method of making a good vinegar. In this, dilute alcoholic liquor to which one one-thousandth part of honey or extract of malt has been added is caused to trickle down through a mass of beech wood shavings previously steeped in vinegar and contained in a vessel called a vinegar generator (*essigbilder*). It may consist of a large oak hogshead or barrel furnished with a loose lid or cover, a few inches below which is fitted a perforated shelf, having a number of small holes loosely filled with packthread about six inches long, knotted at the upper end to prevent their falling through. Several small glass tubes long enough to project slightly above and below the shelf are also fitted in perforations in the shelf to serve as air vents. The vessel at the lower part is pierced with eight or ten holes equally distributed around the sides at about six inches above the bottom, to admit of the entrance of air. A small siphon tube, the upper curve of which is an inch below the air holes, serves to carry off the liquid as fast as it accumulates at the bottom. The alcoholic liquid at a temperature of 75°—83° Fah., is run in on the shelf, and slowly trickles down through the holes by means of the packthread, diffuses itself over the shavings, slowly collects at the bottom, and runs off by the siphon exit. The air enters by the lower holes, passes freely through the shavings, and escapes by the glass tubes. The temperature within the apparatus soon rises to about 100° Fah., and remains stationary at this point while the action goes on favorably. The liquid generally requires to be passed three or four times through the cask before its acetification is complete.

(17) G. F. M. asks: What is the capacity of the Corliss engine used in Machinery Hall at the Philadelphia Centennial, also that of the Sound steamer Providence, and of the largest ocean steamer running into New York—I mean the nominal horse power? A. The Centennial engines were 40 inches cylinder and 10 feet stroke, and called 500 horse power. The Providence is 110 inches cylinder by 14 feet stroke, about 2,000 horse power; the new Cunard steamer Servia, it is expected, will develop 10,000 horse power. There are several Transatlantic steamers that develop over 5,000 horse power.

(18) S. M. writes: We wish to make a covering for stacks of grain or hay, etc., and we saw an article in the SCIENTIFIC AMERICAN, giving a method of waterproofing cloth, on page 394, and wish to inquire whether this is one of the best methods to waterproof cloth, and whether it will prevent the grasshoppers and crickets from eating it? A. Dissolve about 8 ounces of soap in a gallon of boiling water (soft), and with this thoroughly saturate the cloth; wring out the excess of the liquid, and digest the cloth over night in a solution of 10 ounces of alum in a gallon of water; wring out, rinse in clean water, and expose to the air until thoroughly dry. Cloth thus treated is not attacked by insects or animals, resists mildew and moisture, and is sufficiently waterproof for the purpose mentioned.

(19) J. F. F. writes: I should like to experiment with the Plante secondary battery illustrated in recent issue, but before commencing should like to ask a few questions: 1. Can I not make the battery by taking two sheets of lead, six inches wide by three and one half feet long, covering with flannel and red lead same as for plates, and rolling them up together? I think of doing this because of difficulty of obtaining square glass jars here. Both sheets would have same surface as ten plates. A. Yes. 2. How many cells would be required to produce the electric light, using one of Edison's lamps? A. Probably 10 to 15. We have no experiments in this direction, and cannot say definitely. 3. About what candle power lamp would you recommend as being best for experiment or use in a room? A. 16. 4. How should the cells be connected to lamp—for quantity or tension? A. Tension. 5. Could I charge them with four to six cells Calland battery? A. Yes; one at a time, but very slowly. 6. Could they be charged all together, or should they be separate? A. See answer above. 7. How long should they be connected with battery to obtain maximum charge? A. It depends on the strength of the battery.

English Patents Issued to Americans.

From June 28 to July 1, 1881, inclusive.

Bags, coating, I. T. Tichenor, Auburn, Ala.
Cigar lighter, W. W. Batchelder, New York city.
Deadeye, W. P. Healey, Massachusetts.
Electric lighting apparatus, J. J. Wood, New York city.
Engine for compressing air, E. Hill, S Norwalk, Conn.
Exercising machine, J. R. Judd, New York city.
Fare collector, J. J. Greenough, Syracuse, N. Y.
Fog signal, W. B. Barker, Hoboken, N. J.
Fruit storing, G. A. Cochrane, New York city.
Grain treating, T. A. Jebb *et al.*, Buffalo, N. Y.
Hair removing machine, F. Lambert *et al.*, N. Y. city.
Hat bodies, felting, G. Yule, Newark, N. Y.
Lamp, E. P. Follett *et al.*, Rochester, N. Y.
Liquid measure, G. Woolf, St. Louis, Mo.
Saw sharpener, F. Myers, New York city.
Smoke consumer, H. A. Hogel, New York city.
Spinning machinery, P. Townson, Thompsonville, Conn.
Steam, appar. for distributing, B. Holly, Lockport, N Y.
Steam, appar. for distributing, B. Holly, Lockport, N. Y.
Violin, E. Berliner, Boston, Mass.

NEW BOOKS AND PUBLICATIONS.

THE COMPLETE BREAD, CAKE, AND CRACKER BAKER. Chicago: J. Thompson Gill, Manager "Confectioner and Baker" Publishing Company.

A practical hand book for the confectioner and baker, comprising. (I.) The science and art of baking; (II.) Formulæ and memoranda. The first part contains a brief statement of the scientific principles underlying the breadmaking processes, the selection and preparation of materials, the practical operations of mixing, and the construction and use of the ovens and other machinery employed by bakers. Part II. contains a great variety of practical recipes, the proportions being usually expressed in terms to permit of easy subdivision or multiplication for smaller or larger batches. Though specially designed for the professional baker the work is likely to be a useful adjunct to every kitchen.

WATER WORKS STATISTICS, 1881. London: Charles W. Hastings.

The first issue of British water works, statistics after the style of Mr. Hastings' compilations of gas works statistics. Returns are given from 134 towns, most of them giving full information touching the source of water supply, quantity, mode of distribution, cost, character of service, price per 1,000 gallons, etc., etc.

DIE DARSTELLUNG DES EISENS UND DER EISEN FABRIKATE. (Manufacture of Iron and Iron Articles.) By Edward Japing. Wien. Pest. Leipzig. A. Hartlebens. Verlag. 1881. 244 pp.

The author of this work has taken great pains to give all information possible in a thorough manner and in precise clear language. The first chapter describes the appearance, characteristics, and classification of iron ores and iron. The second chapter treats of the various methods of producing the different kinds of cast and wrought iron and steel; and the third chapter describes the methods of casting iron and steel, the furnaces used, implements, etc. The remaining seven chapters treat of the manufacture of wrought and rolled iron, sheet iron, boiler iron, wire, tubes, plating tinning, galvanizing, enameling, cutting, punching, annealing, tempering, planing, etc. The last chapter describes the manufacture of small iron articles such as nuts, screws, chains, wire netting, cutting devices, etc. The entire field of iron industry is thoroughly explained, and the publication will be found to be a great help to the young ironworker. The work is provided with numerous illustrations.

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THE WILDERNESS CURE. By Marc Cook. New York: William Wood & Co.

The curative value of out-door life in the Adirondacks in incipient consumption of the lungs was demonstrated in the writer's case twenty-five years before Mr. Cook set up "Camp Lou." Taken soon enough by one who thoroughly enjoys wood ranging, the wilderness cure is very likely to be a sure cure. But to the vast majority of consumptives the wilderness is the worst possible resort. All the advantages attending tent life in the wilderness—and they are many—can usually be secured within an hour's ride of home, often within a stone's throw, with none of the risks or discomforts entailed by banishment from home and civilization.

SCIENTIFIC INDUSTRIES EXPLAINED. By Alexander Watts. Edinburgh and London: W. & A. K. Johnston. 12mo, pp. 203. 2s. 6d.

It is hard to estimate the utility of a book like this. The descriptions given of the more important applications of science to manufactures are correct, and clear enough to such as are fairly well versed in chemistry. But they are too brief to satisfy such readers, while to the unscientific the style is too technical on the whole to be easily intelligible. Still it may prove a handy reference book to those of liberal education, so-called, whose studies have not embraced much of industrial chemistry and whose library is small.

MECHANICAL ENGINEERING. By Francis Campin, C.E. London: Crosby, Lockwood & Co. 2s. 6d.

No. 223 of Weale's Rudimentary Series; substantially an abridgment of Mr. Campin's large treatise on practical engineering, with some additions and substitutions of recent matter.

THE GAS AND WATER COMPANIES' DIRECTORY, 1881. Edited by Charles W. Hastings, London.

This, the fifth issue of the directory, shows a great improvement in form, and the editor thinks also in fullness and accuracy. It furnishes classified lists of the gas companies of England, Scotland, Wales, and Ireland, and the more important companies of Europe, Asia, and Australia, with statements of capital, officers, etc., etc. The water companies of Great Britain are similarly represented.

GAS WORKS STATISTICS, 1881. London: Charles W. Hastings.

The third annual issue of Mr. Hastings' useful compendium of British gas works statistics. Returns are given from 726 towns, showing tons of coal carbonized, make of gas, illuminating power of gas, price per thousand feet, price paid for public lamps, dividends, etc.

PAPERS READ BEFORE THE PI ETA SOCIETY, RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y. Vol. II. No. 2. 1881.

The papers for this issue comprise: The Camber of Bridges, Thos. M. Cleemann, C.E.: the Interoceanic Canal, W. E. Danely, C E.; Bridge Lines, their Sizes and Bearings, J. A. L. Waddel, C E.; Rational Fractions, Adolfo E. Besora, C.E; Note on Gordon's Formula for Long Columns, W. H. Burr, C.E.; The Size of the Angle Block in a Howe Truss Bridge, by Thos. M. Cleemann, C.E.; Discussion of Paper on Braced Iron Piers, by W. H. Burr, C.E.

PAPERS OF THE ARCHÆOLOGICAL INSTITUTE OF AMERICA. American Series, II. By A. F. Bandelier. Boston: A. Williams & Co. 8vo, pp. 133.

The initial publication of the American series embraces two papers: 1. Historical introduction to studies among the sedentary Indians of New Mexico; 2. Report on the ruins of the Pueblo of Pecos. In the first paper Mr. Bandelier gives a critical review of the historical references to the seven cities, caves, or ravines, and their inhabitants; and in the second he recounts his observations among the aboriginal ruins in the valley of the Pecos. He does not attach to the Montezuma tale any historical importance whatever—not even a traditional value.

HAND BOOK OF PRACTICAL LANDSCAPE GARDENING. By F. R. Elliott. Rochester: D. M. Dewey. 8vo, cloth, pp. 96.

A second and improved edition of Mr. Elliott's practical hand book. A brief chapter on the principles of landscape gardening and the treatment of ornamental plants is followed by condensed descriptions of the principal trees and shrubs available for decorative purposes, shade, hedges, screens, etc. Then are given a dozen or more designs for lots and grounds, from a city lot in size to a 40 acre plot, each plan being drawn to scale, with specific directions for the planting of each tree and shrub. Several colored illustrations of trees and flowers serve to embellish the book, which can hardly fail to be useful to householders of moderate means who wish to make the most of their opportunities.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. In ten parts. New York: William T. Comstock. $1 a part.

The tenth and concluding part of this compilation of architectural details suited to popular styles of house building of the less expensive sort, contains views, plans, and details of a handsome brick and frame cottage, the same for a dwelling in the Elizabethan style, and a number of ornamental designs for ventilating registers, chimney tops, and so on. The entire series comprises nearly 700 details, drawn to a large scale, as are all the plans and elevations. The work cannot fail to be suggestive and useful to all builders of suburban and country dwellings.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. New York: William Comstock. Folio. $1.

Part 9 of this useful series includes plates 65 to 72, and contains perspective views, elevations, and plans of several artistic country houses, one with Eastlake features, each accompanied by a multitude of details.

[OFFICIAL.]

INDEX OF INVENTIONS

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Letters Patent of the United States were Granted in the Week Ending

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A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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[From Rev. Dr. Bridgeman.]

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[From the Mayor of Saratoga.]

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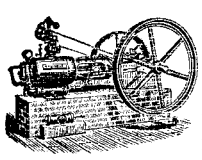

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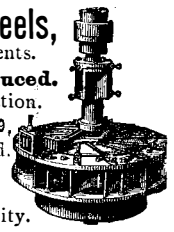

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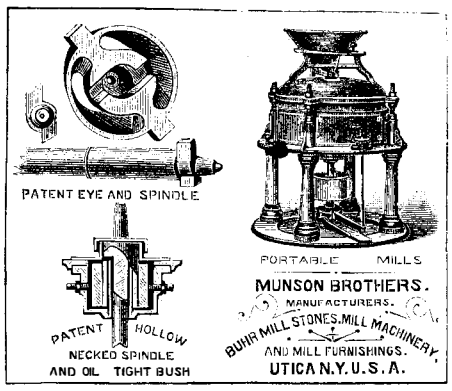
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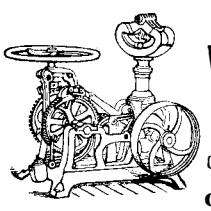

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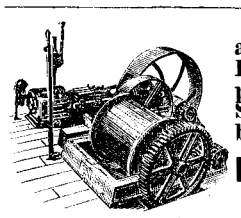

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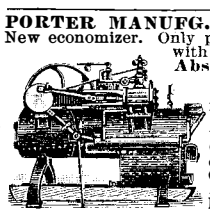

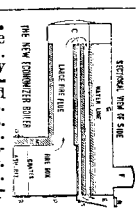

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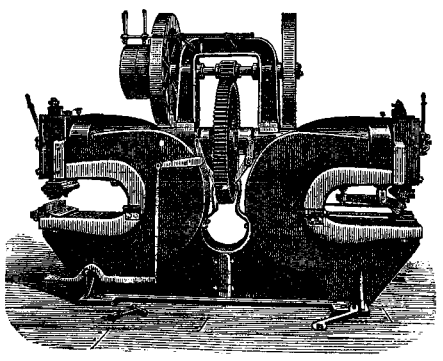

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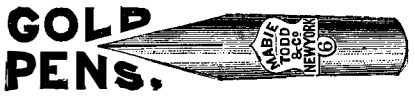

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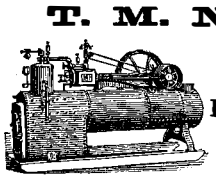

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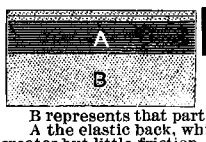

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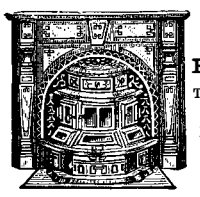

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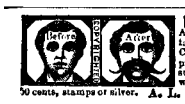

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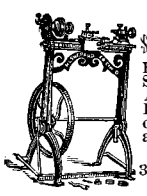

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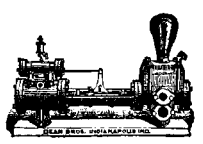

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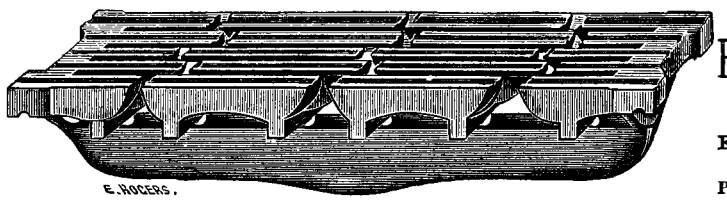

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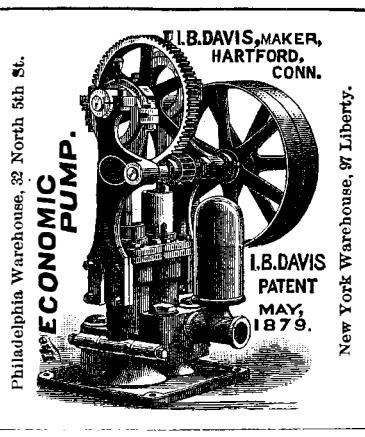
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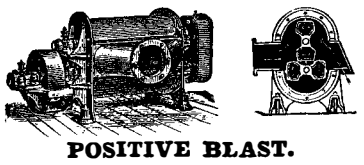

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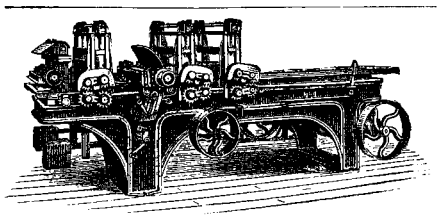

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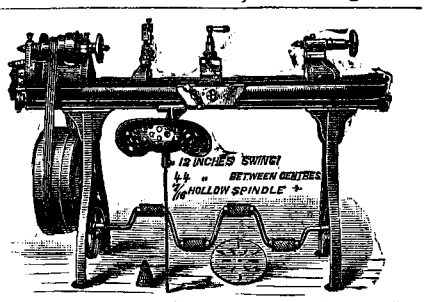

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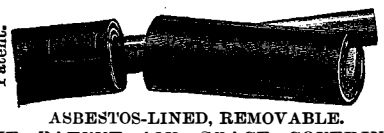
Toope's Patent.  August, 1879.
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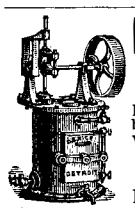
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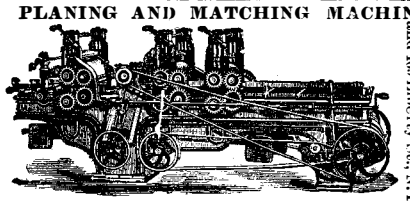
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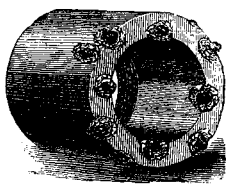
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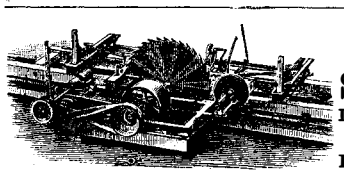
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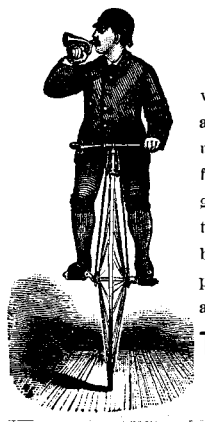
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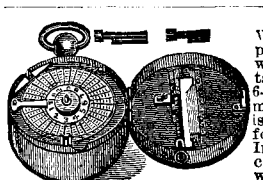
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